

REPAIR MANUAL



183HD

233HD

FOREWORD

This repair manual provides information for the proper servicing and overhaul of Thomas Model T193HD and T233HD Loaders and is an essential publication for all service personnel carrying out repairs and maintenance procedures.

This manual covers units produced in 05-86 and later. Special service instructions are identified by loader serial number or applicable production dates throughout the text.

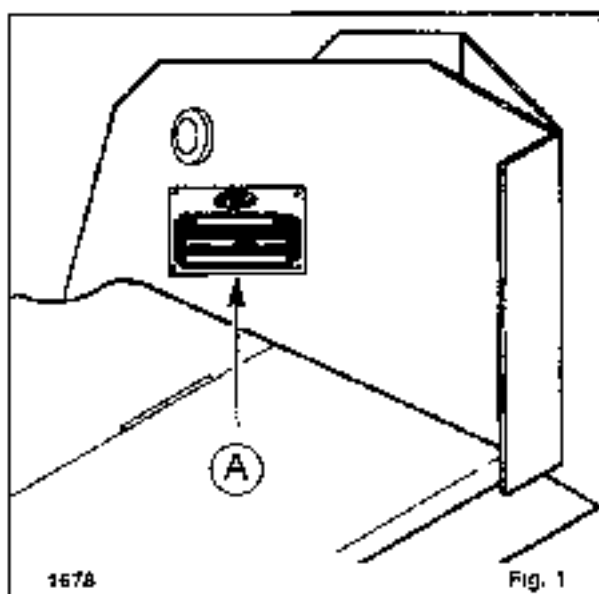
The manual is divided into 9 sections, each divided into subsections. Each subsection contains information on general operating principles, detailed inspection and overhaul and, where applicable, trouble shooting, special tools and specifications.

The material contained in this manual was correct at the time of going to print but 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.

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SERIAL NUMBERS



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 driver's seat looking in a forward position.

A vehicle identification plate is located on the inside of the fuel 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.



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 practices 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 chiseling, grinding, dicing, welding, painting, etc.
- **Breathing Protection**
Fumes, dust and paint spray are unpleasant and harmful. These can be avoided by wearing respiratory protector.
- **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 heels 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 BARG) 7 (kg/cm²). It is perfectly safe if used correctly. Any misuse may cause injury.
Never use compressed air to blow dust, filings, 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 hit 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, 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, repair 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 result in:
 - Fire
 - Electric shock
 - Death
 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 everyone.

• 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 suspension parts.

• First Aid

In the type of work that mechanics are engaged in (oil, grease, fine dust, etc.) it is better to treat 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 a trivial crack becomes painful and injurious. It only takes a few minutes to have a trash 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

• Do not enter or exit the caber unless the boom arms are fully down and the engine is off. Cycle the foot pedals to ensure they are locked in neutral before exiting the loader.

• Stop the engine before performing any service.

• Place a warning sign or markers 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 bypass 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 up on soft ground. Always take the unit to an area which has a hard wearing 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 ladders or working platforms when servicing those areas of a loader that are not within easy reach.

• Before loosening any hoses or lines, 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 on both 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 the boom fully down and stop at the engine 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 a 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 hands 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. Turn off connections before starting engine or pressurizing lines. If any fluids are injected into the skin, obtain medical attention immediately as gangrene may result.

- Prior to removing wheels and tires from a loader, check to determine whether additional ballast (fluid 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 tire pressure. Over inflated or run down tires in most any result in personal injury.

Safety precautions are very seldom the figment of some one'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 tractor 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 efficiency and working life of a component and lead to costly replacement.

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.

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.

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.

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 rattling.

The hoses are one aspect of the unit. Be sure they are in good condition when carrying out repairs or maintenance otherwise the machine's 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.

Be sure any hose which has been installed is not kinked or twisted.

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

A hose with a cracked 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 otherwise hoses generally suffer from structural damage which can result in oil restriction or a reduction in the speed of operation and ultimate hose failure.

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

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.

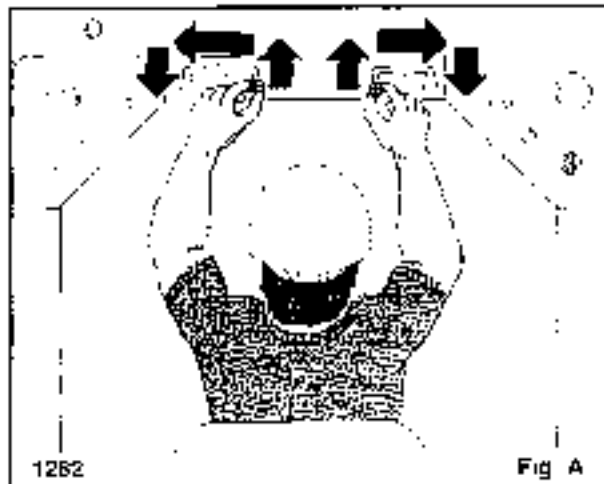
When bearings or bushings are removed always carefully check that the bearing is free from discoloration and signs of over-heating. Also check for mechanical damage such as excessive clearance, nicks and scuffing. If in doubt replace the bearings or bushings.

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.

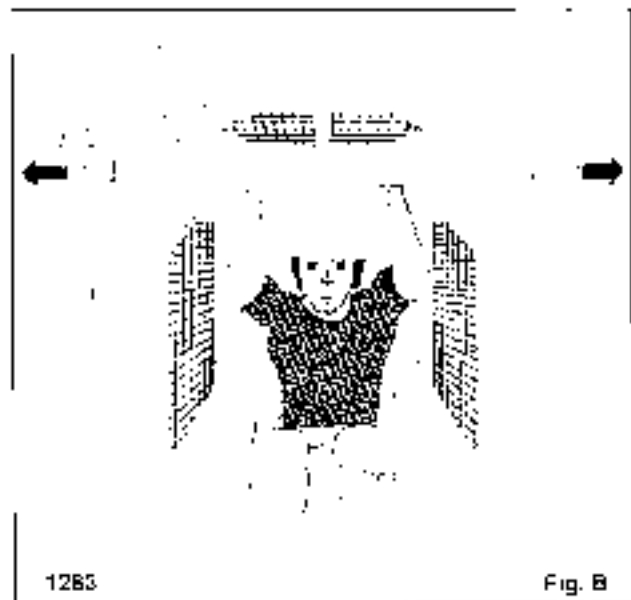
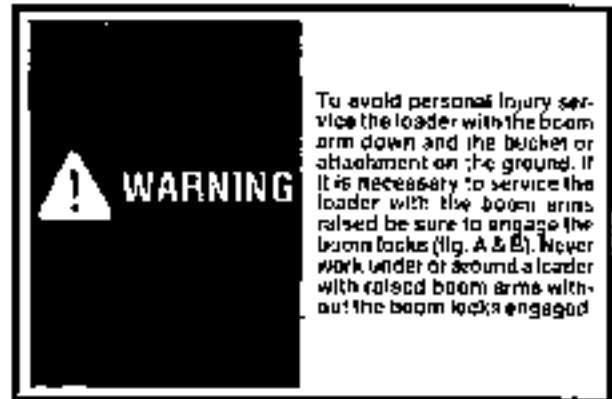
Be sure during normal routine servicing, maintenance or repair that bearings are given the right attention and are installed with care.



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.



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SECTION 1 HYDRAULICS

1.1.1 Specifications: T183HD

Pump type	Gear	
Capacity (at rated RPM and Pressure)	17 GPM (64.4 l/m)	
Rated RPM	2950	
Rated Pressure (at rated RPM)	2150 PSI ± 50 (148 BAR ± 3.4) @ 160°F (71°C)	
Reservoir Capacity	18 gal (68 l)	
Fluid type	10W30 API class SE, CD oil	
Filtration	10 Micron	
Filtration, reservoir	Two, 100 Micron Elements	
Control valve, type	Sections: Body with lift or tilt and doler or auxiliary	
Oil cooler	420 BTU	
Cylinders	Lift	Tilt
Type	Double Acting	Double Acting
Qty. per machine	2	2
Bore dia.	2.5 in.	3.0 in.
Rod dia.	1.5 in.	1.5 in.
Stroke	27.75 in.	15.5 in.

1.1.2 General Information — Hydraulic System

Operation: T183HD

(Refer to Illustration 1.1.2)

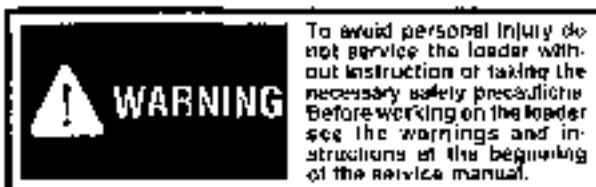
Oil flows from the hydraulic reservoir (1) through a 100 micron element (2) located in the reservoir to the hydraulic pump (3).

The hydraulic pump (3) is a gear type pump which is driven by a shaft through the hydrostatic drive pumps (4) at engine speed. The hydraulic pump (3) capacity is directly related to engine speed. Oil goes from the hydraulic pump (3) to the hydraulic control valve (5).

The hydraulic control valve (5) is equipped with an adjustable relief valve (6) which is set at 2150 PSI (148 BAR). The hydraulic control valve (5) is a sectional body spool type valve. The third section provides hydraulic flow to the two bucket cylinders (7). The center section provides flow to the auxiliary hydraulic circuit (8) allowing operation of hydraulic attachments and tools. The center section is equipped with a doler position to allow constant flow to the auxiliary hydraulic circuit (8). The first section provides hydraulic flow to the two boom lift cylinders (9). The lift section is equipped with a float position.

Oil flows from the control valve to the hydraulic filter (10). The hydraulic filter (10) 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 (10) through a 420 BTU hydraulic oil cooler (11). Oil flows from the hydraulic oil cooler (11) to a tee (12) located at the hydraulic reservoir (1). Oil flows from the tee (12) into the hydraulic reservoir (1) through a 100 micron element (13) and also to the hydrostatic drive pump (4) charge pump inlet (14). All hydraulic oil flowing to the hydrostatic drive pumps passes first through the 10 micron hydraulic filter (10) and the hydraulic oil cooler (11).



SECTION 1 HYDRAULICS

1.1.3 Specifications: T233HD

Pump type	Gear	
Capacity (at rated RPM and Pressure)	16.2 GPM (57.4 ltr)	
Rated RPM	2800	
Rated Pressure (at rated RPM)	2150 PSI \pm 50 (148 BAR \pm 3.4) @ 160°F (71°C)	
Reservoir Capacity	18 gal. (68 l)	
Fluid type	10W30 API class SE, CD oil	
Filtration	10 Micron	
Filtration, reservoir	Two, 100 Micron Elements	
Control valve, type	Sectional Body with Detent on lift and detent on auxiliary 920 BTU	
Oil cooler	Lift Lift	
Cylinders	Lift Lift	
Type	Double Acting	Double Acting
Qty. per machine	2	2
Bore dia.	3.0 in.	2.5 in.
Rod dia.	2.0 in.	1.5 in.
Stroke	28 in.	15.75 in.

1.1.4 General Information — Hydraulic System

Operation: T233HD

(Refer to illustration 1.1.4)


Oil flows from the hydraulic reservoir (1) through a 100 micron element (2) located in the reservoir to the hydraulic pump (3).

The hydraulic pump (3) is a gear type pump which is driven by a shaft through the hydrostatic drive pumps (4) at engine speed. The hydraulic pump (3) capacity is directly related to engine speed. Oil goes from the hydraulic pump (3) to the hydraulic control valve (5).

The hydraulic control valve (5) is equipped with an adjustable relief valve (6) which is set at 2150 PSI (148 BAR). The hydraulic control valve (5) is a sectional body series type valve. The third section provides hydraulic flow to the two bucket cylinders (7). The center section provides flow to the auxiliary hydraulic circuit (8) allowing operation of hydraulic attachments and tools. The center section is equipped with a detent position to allow constant flow to the auxiliary hydraulic circuit (8). The first section provides hydraulic flow to the two boom lift cylinders (9). The lift section is equipped with a float position. The adjustable self leveling valve (15) keeps the attachment at the same level during upward operation of the lift circuit.

Oil flows from the control valve to the hydraulic filter (10). The hydraulic filter (10) 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.

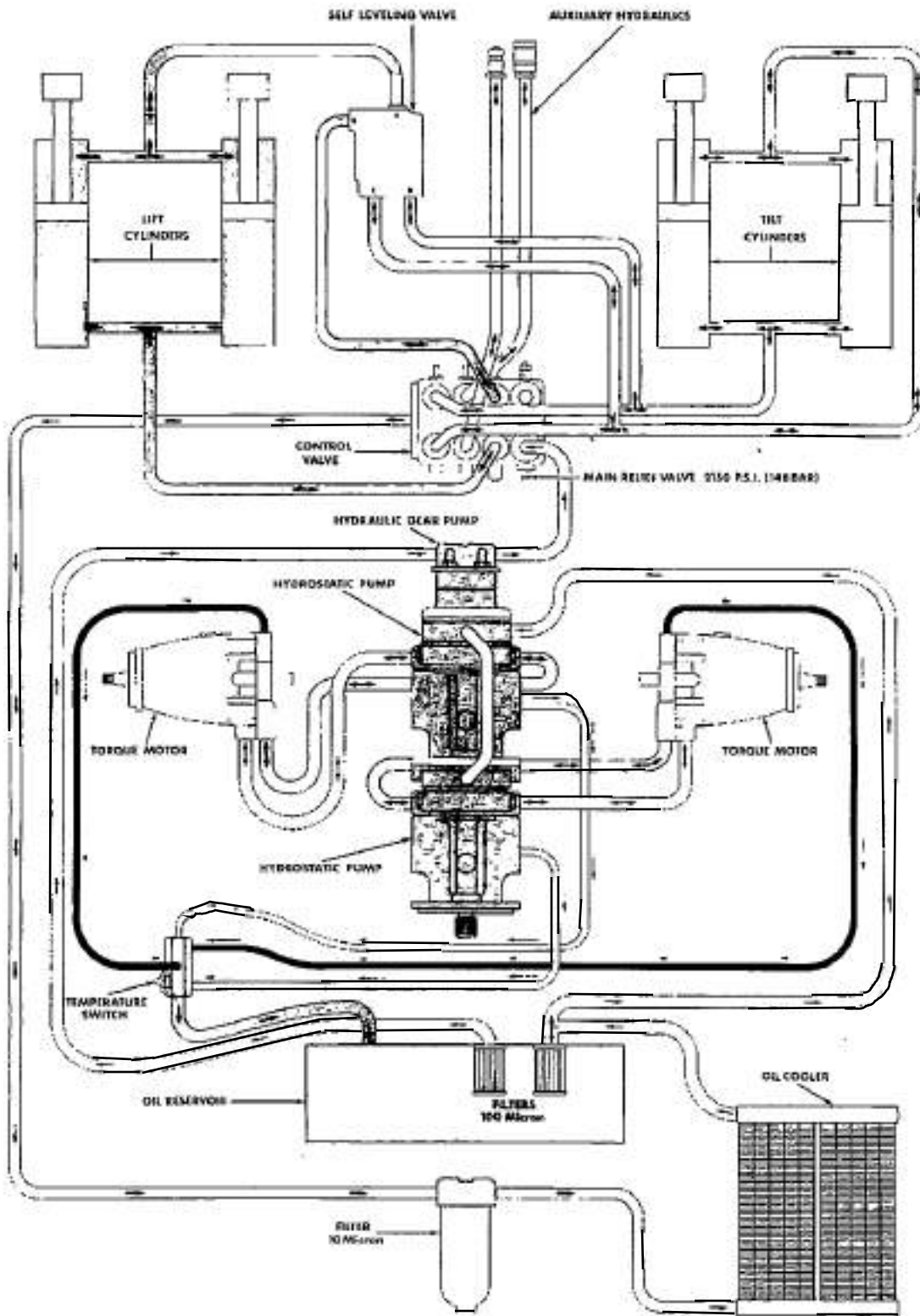
Oil flows from the hydraulic filter (10) through a 920 BTU hydraulic oil cooler (11). Oil flows from the hydraulic oil cooler (11) to a tee (12) located at the hydraulic reservoir (1). Oil flows from the tee (12) into the hydraulic reservoir (1) through a 100 micron element (13) and also to the hydrostatic drive pump (4) charge pump inlet (14). All hydraulic oil flowing to the hydrostatic drive pumps passes first through the 10 micron hydraulic filter (10) and the hydraulic oil cooler (11).



WARNING

To avoid personal injury do not service the loader without instruction or taking the necessary safety precautions. Before working on the loader see the warnings and instructions at the beginning of the service manual.

SECTION 1 HYDRAULICS



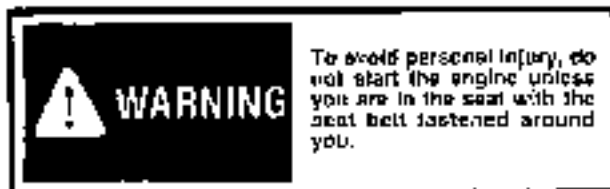
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Fig. 1.1.4

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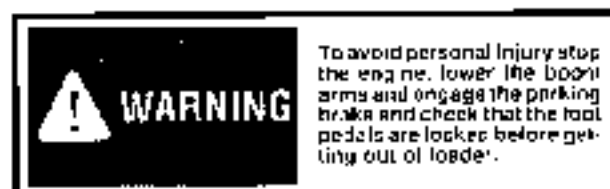
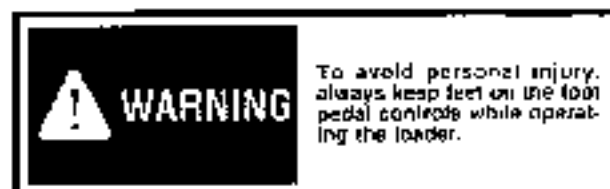
1.1.5 Control Functions:

The T133HD compact loader has a rated lift capacity of 1900 lbs. (816 kg.) to full height. The T293HD has a rated lift capacity of 2300 lbs. (1047 kg.). Operation of the loader hydraulic functions are controlled by three foot pedals (Fig. 1.1.5).

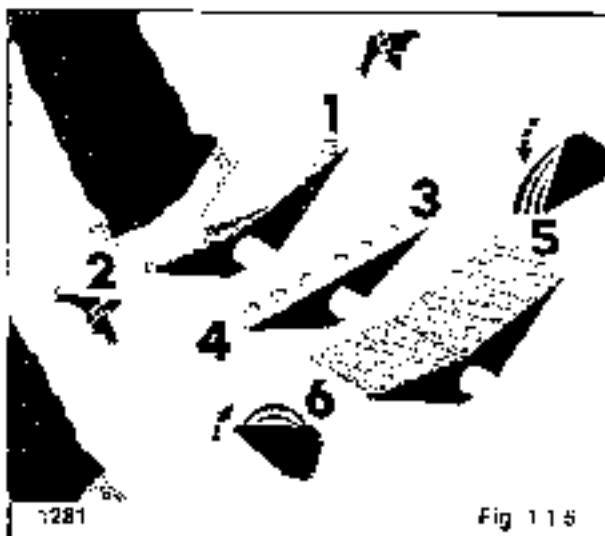


Boom Lift — The L.H. pedal is the boom lift control (Fig. 1.1.3). To raise the boom press on the heel (2) of the pedal. To lower the boom press on the toe (1) of the pedal. Firm pressure on the toe (1) of the pedal will lock the boom in float position. This allows the bucket to follow the ground as the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

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 default 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.



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 the bucket back.

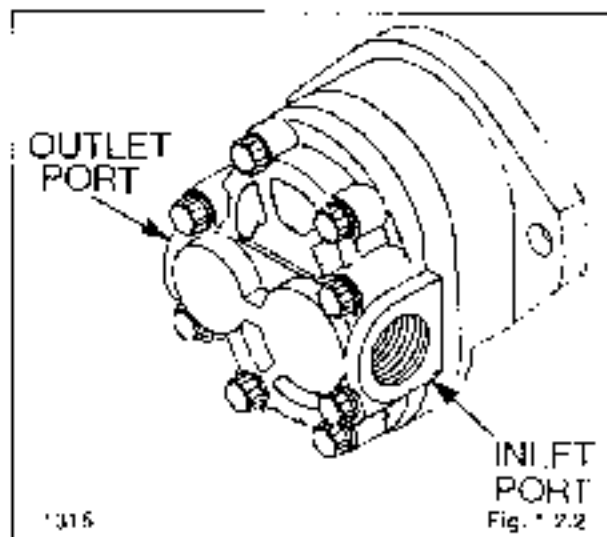


1.1.6 Maintenance Schedule:

	First (Hours)	Every (Hours)
Foot pedal locks	0	8
Oil level check	0	8
Oil filter change	50	150
Oil cooler, clean	8	8
Gener. system check (leaks, etc.)	8	8
Cylinders, lubricate	8	8
Reservoir filters, change	1000	1000
Hydraulic oil change	1000	1000

* Check foot pedal locks and all safety equipment each time the loader is operated.

1.2 GEAR PUMP



SECTION 1 HYDRAULICS

1.2.1 Specifications:

	T183HD	T233HD
Pump type		Gear
Displacement	1.48 cu. in. (24.3 c.c.)	
Capacity (at rated speed and pressure)	17 GPM (64.4 l/m)	16.2 GPM (61.4 l/m)
Rated speed (RPM)	2950	2800
Rated pressure (at rated RPM)	2150 PSI = 50 (148 BAR = 3.4) MPa 160°F (71°C)	
Rotation	R-L (viewed from shaft end)	
The bolt torque	25-28 ft lbs (34-38 N.M.)	

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 speed.

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 Hydraulic Pump Flow:

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

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

Pressure Gauge — Capable of reading up to 3000 PSI (206.8 BAR)

1. This test must be performed with the engine running. Before performing the test, block the loader securely with all four wheels clear of the ground.
2. Remove the seat and the front shield.
3. Disconnect the line between the hydraulic gear pump and control valve (fig. 1.2.3a).



WARNING

To avoid 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.

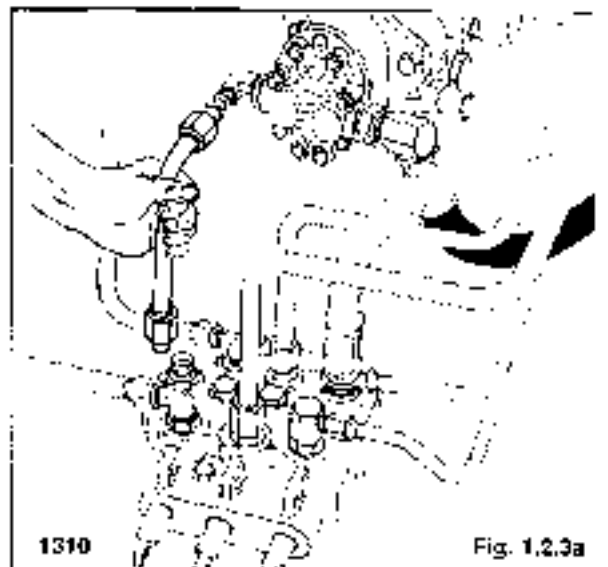


Fig. 1.2.3a

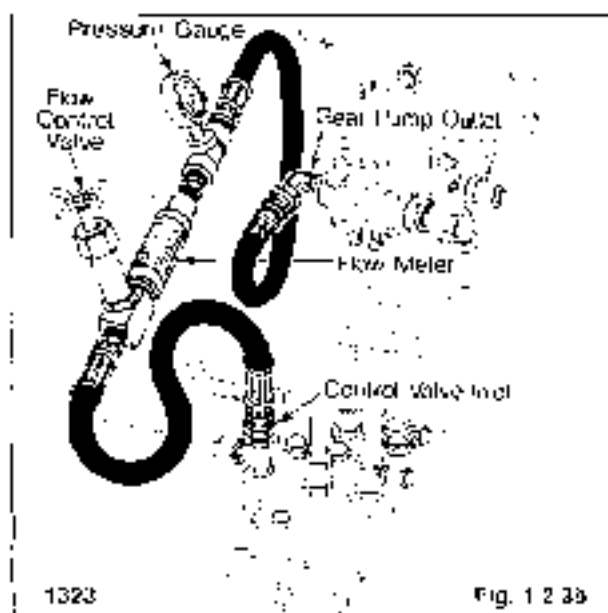
4. Connect the hydraulic tester between the gear pump and the hydraulic control valve (fig. 1.2.3b).

The inlet hose from the hydraulic tester connects to the outlet port of the hydraulic gear pump.

The outlet hose from the tester connects to the control valve inlet port. Ensure the flow control on the hydraulic tester is fully open before starting the engine to prevent damage to the gear pump.

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 2150 PSI (148 BAR).



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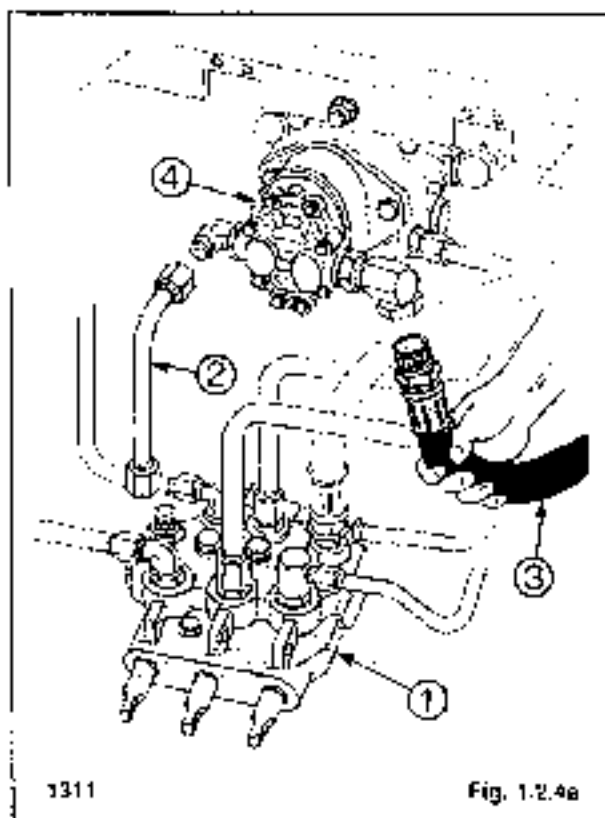
Fig. 1.2.3b

SECTION 1 HYDRAULICS

5. With the flow control on the tester fully open, start the engine and run it until it reaches normal operating temperature.
6. Set the engine speed to 1700 RPM and record the flow meter reading under no load conditions. (Refer to section 4.4 on setting the engine speed)
7. Apply load gradually to 2150 PSI (148 BAR). Correct the engine speed to 1700 RPM by increasing the throttle. Record the flow meter reading under load.

NOTE: The flow readings taken at no load and at 2150 PSI (148 BAR) must be at a constant 1700 RPM. If the RPM is not kept constant, the flow readings will be incorrect and pump efficiency will not be determined properly.

8. Determine pump efficiency by dividing the no-load reading into the 2150 PSI (148 BAR) reading. If the efficiency is less than 75% the pump should be repaired or if necessary replaced.
9. Disconnect the tester. If the pump is not to be removed from the loader reconnect the hydraulic line between the control valve and gear pump.



1311

Fig. 1.2.4a

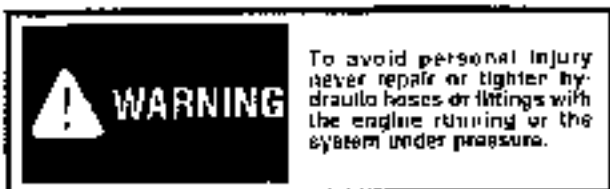
1.2.4 Gear Pump — Removal:

REMOVAL:

1. Remove the seal and the front shield.



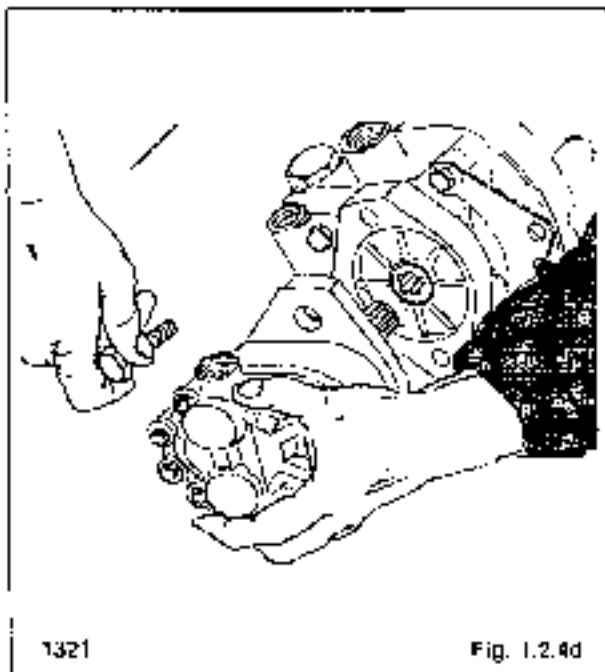
2. Disconnect the line between the hydraulic oil reservoir and the hydraulic gear pump at the gear pump inlet port (Fig. 1.2.4a). Cap the hose with a 3/4 inch N.P.T. cap to prevent loss of hydraulic oil.



3. Disconnect the line between the hydraulic gear pump and the control valve (Fig. 1.2.4a)

Remove the two bolts which hold the hydraulic gear pump to the hydrostatic pump (Fig. 1.2.4d).

On reassembly torque the two mounting bolts 27-31 ft. lbs. (37-42 N.M.)



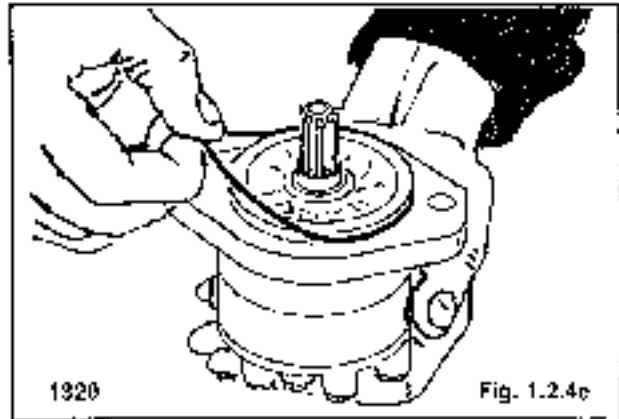
1321

Fig. 1.2.4d

SECTION 1 HYDRAULICS

Remove the O-Ring from the mounting flange of the hydraulic gear pump (fig. 1.2.4e)

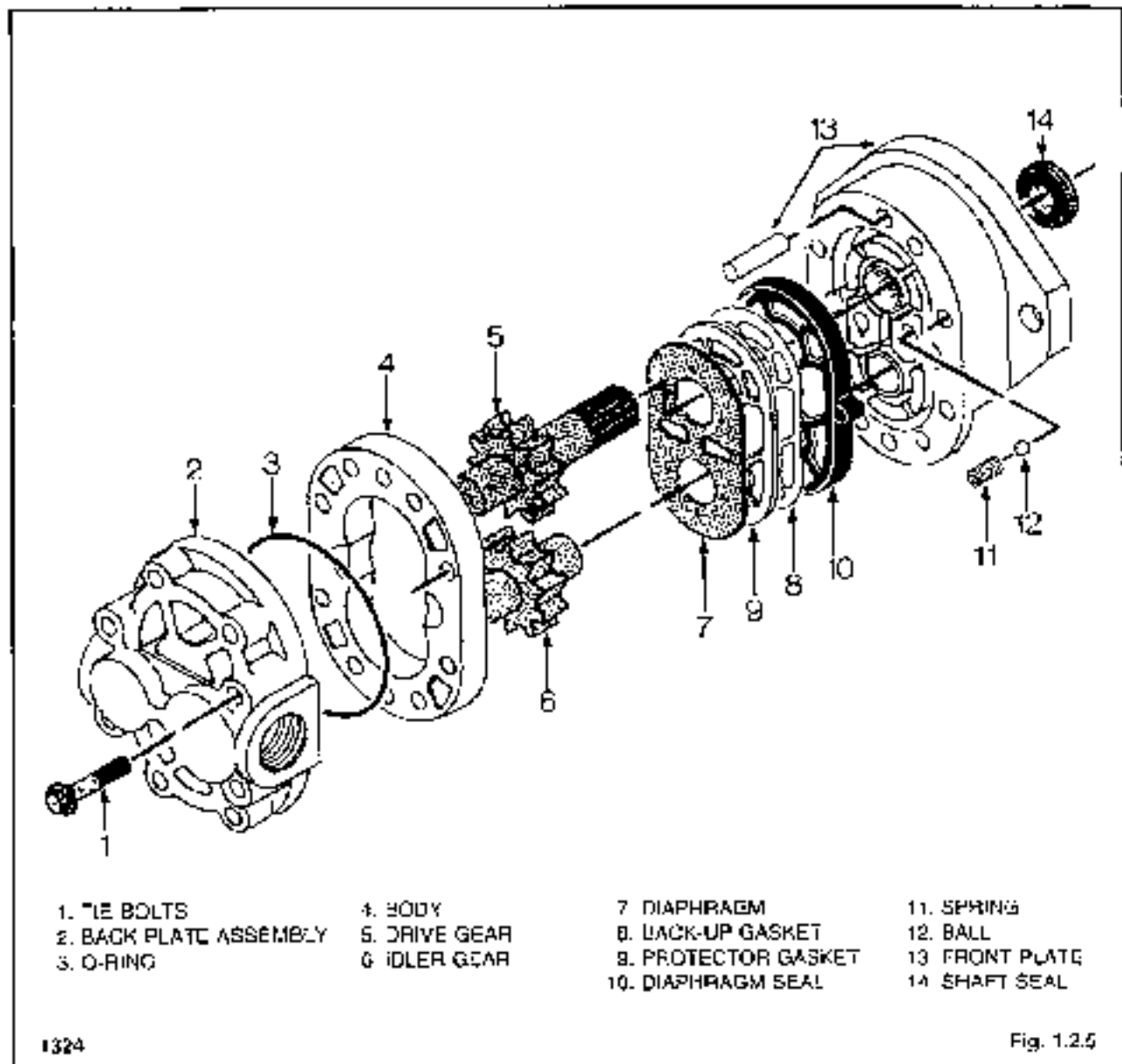
On reassembly install a new O-Ring.



1320

Fig. 1.2.4e

1.2.5 Disassembly and Inspection:



1324

Fig. 1.2.5

SECTION 1 HYDRAULICS

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.



DISASSEMBLY — (Refer to fig. 1.2.5)

1. Remove the eight tie bolts (1)
2. Hold the pump in both hands and tap the drive shaft against a wooden block to separate the front plate (3) from the back plate (2). The body (4) will remain with either the front plate or back plate.
3. To separate the body from the section it remains with place the drive gear (5) in the body and tap the protruding end of the gear shaft with a plastic mallet.
4. Remove O-Ring (3) from the back plate and discard.
5. Using a sharp tool remove and discard the diaphragm (7) from the front plate.
6. Remove the two springs (11) and two balls (12) from the front plate.
7. Remove and discard the back-up gasket (8), protector gasket (9) and the diaphragm seal (10) from the front plate.
8. Remove and discard the shaft seal (14) 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 raised portions of the groove pattern.
 - (b) The oil grooves in the bearings should line up with the dowel pin holes and be 180° apart for both front and back plate.
 - (c) The inside diameter of each bearing should not exceed .891 in. (22.7551 mm).

5. Inspect the gear pockets of the body for excessive scoring or wear.

REASSEMBLY —

The diaphragm, back-up gasket, diaphragm seal, protector gasket, O-ring and shaft seal should be replaced as new parts during reassembly.

1. Using a dull tool fit the diaphragm seal (10) into the groove in the front plate with the open part of the "V" section facing down.
2. Press the protector gasket (9) and the back-up gasket (8) into the diaphragm seal.
3. Insert the two steel balls (12) into their respective seats and place the two springs (11) over the balls.
4. Place the diaphragm (7) on top of the back-up gasket with the bronze face up.
5. Check that the entire diaphragm fits inside the raised rim of the diaphragm seal.
6. Dip the gear assemblies in system oil and install into the front plate bearings.
7. Apply a thin coat of heavy grease to both milled faces of the body. Install the body over the gears onto the front plate. The hollow, port cavities in the body must face away from the front plate and the small drilled hole in one of the cavities must face the outlet (pressure) side of the pump.
8. Install O-Ring (3) in the groove on the backplate.
9. Slide the back plate over the gear shafts until the dowel pins are engaged.
10. Install and evenly tighten the eight tie bolts (1) torque to 25-28 ft lbs (34-38 N.M.).
11. Dip the shaft seal (14) in system fluid and install it on the drive shaft being careful not to cut the rubber sealing lip. Fully seal the seal into the recessed bore in the front plate.
12. Hold 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.

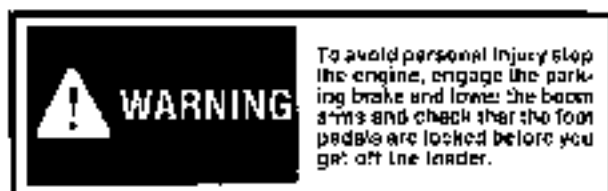
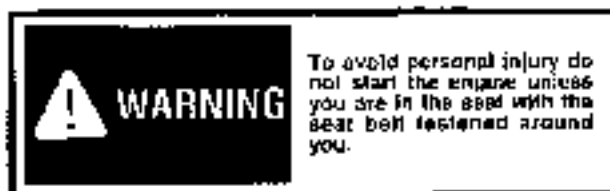


1.2.6 Start-up After Repair:

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

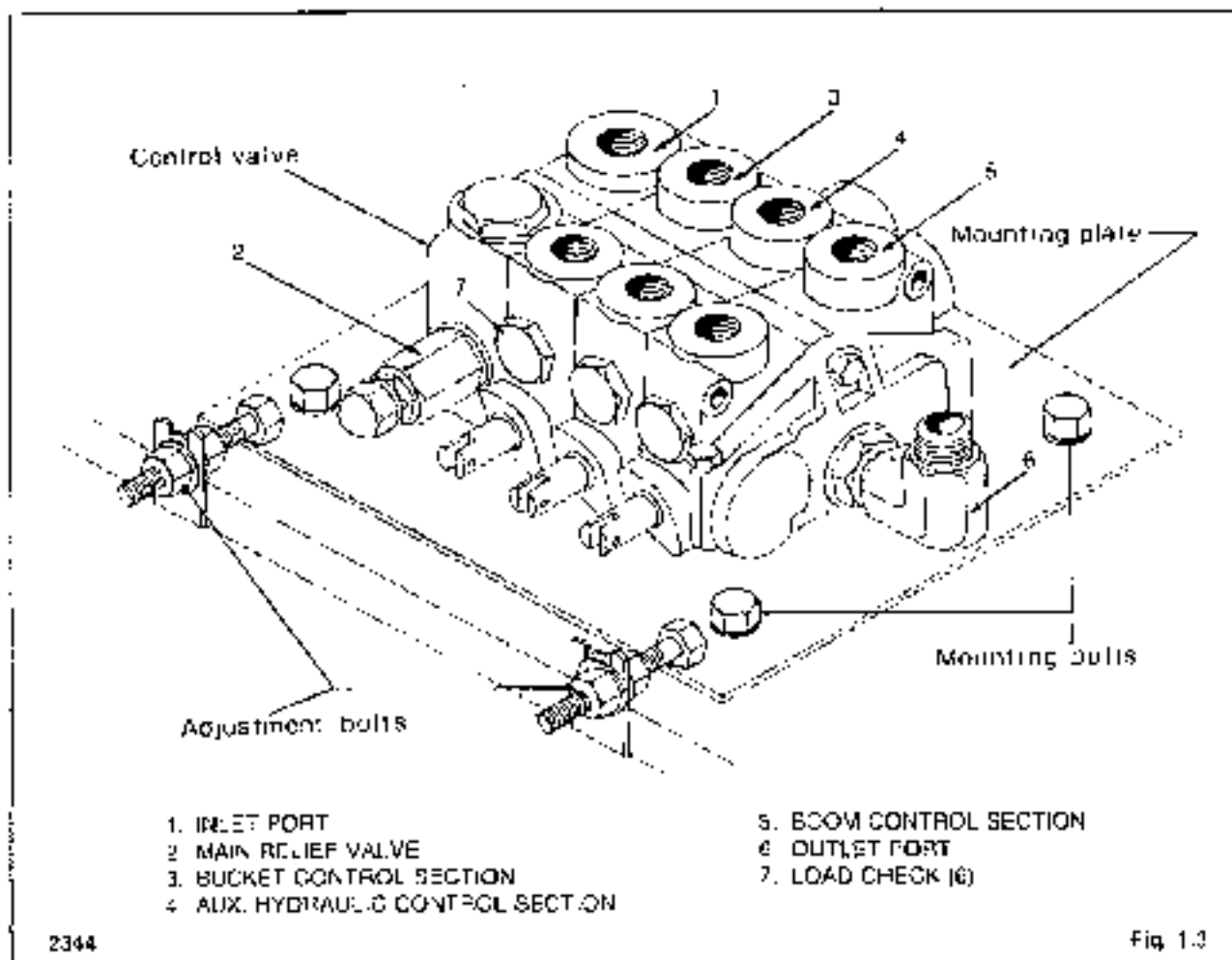
SECTION 1 HYDRAULICS

1. Fill the hydraulic oil reservoir to the correct level with 10W30 API classification SE, CD oil. Refer to section 1 & 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.
On gasoline engines — disconnect the coil wire and follow the above procedure.
3. Start the engine and run it at half throttle with 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 3 second intervals for approximately three minutes.
6. Shut off the engine and check for leaks.



7. Change the hydraulic oil filter after 2 hours of operation and again at 50 hours after the repair.

1.3 CONTROL VALVE



SECTION 1 HYDRAULICS

1.3.1 Specifications:

Model	G-60301 - V20
Valve type	series type with float on boom & aux. detent
Flow capacity	20 GPM (75.7 l/m)
Main relief type	Pilot operated, adjustable
Main relief setting (at rated RPM)	2150 PSI \pm 50 (148 BAR \pm 3.4)
Lead check	6 per valve

1.3.2 General Information:

LOADER CONTROL VALVE

The loader hydraulic control valve is a series type, sectional type valve. The valve contains 3 sections which control loader bucket, auxiliary hydraulic and boom operations.

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

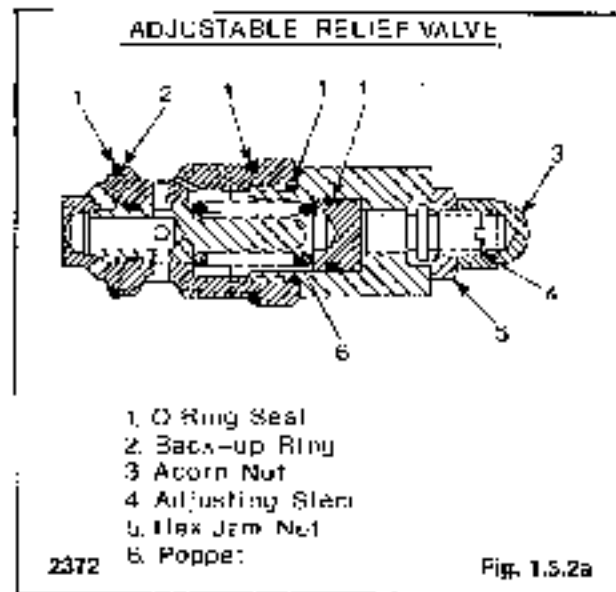
When the spools are in neutral oil flows from the hydraulic gear pump, through the control valve, and returns to the hydraulic reservoir. As a spool is moved, oil is directed to one end of the cylinders. Oil returning from the cylinders is ported to the next valve section which allows operation of more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

SYSTEM RELIEF VALVE OPERATION

The system relief valve (fig. 1.3.2a), is located at the front of the valve near the inlet port between the high pressure passage and the low pressure passage. 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 a pilot operated relief and is adjustable. Refer to section 1.3.3. The relief valve is present at 2150 PSI \pm 50 (148 BAR \pm 3.4) at 1600°F (71°C) at Rated RPM.

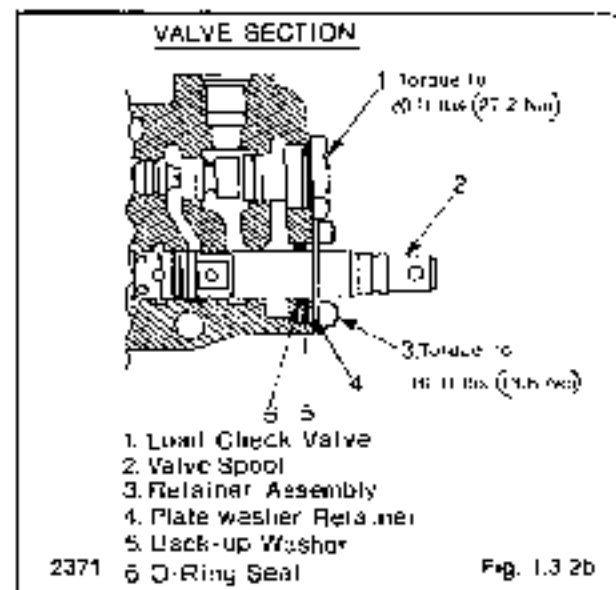


1. O Ring Seal
2. Back-up Ring
3. Acorn Nut
4. Adjusting Stem
5. Hex Jam Nut
6. Poppet

LOAD CHECK VALVE OPERATION

2 load check valves are located in each valve section. The function of the check valves is to hold the boom arms or bucket in position during their 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.



1. Load Check Valve
2. Valve Spool
3. Retainer Assembly
4. Plate washer Retainer
5. Back-up Washer
6. O-Ring Seal

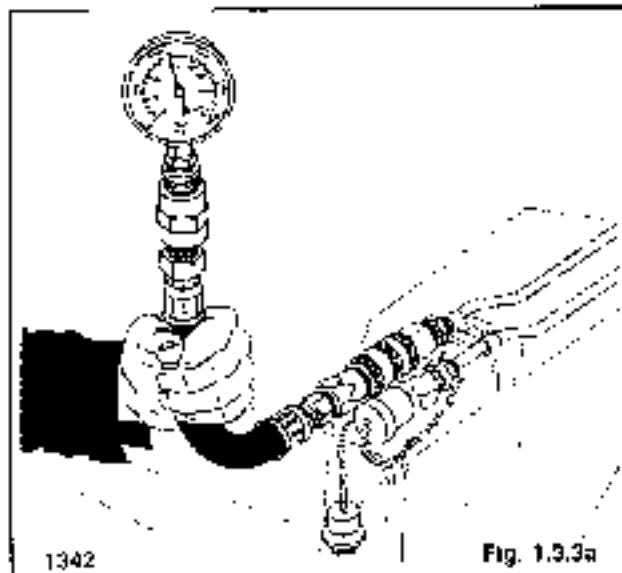
SECTION 1 HYDRAULICS

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 2000 PSI (206.8 BAR) continuous pressure when performing the test.

1. Operate the loader until the hydraulic oil is warm. Shut off the engine.
2. This test must be performed with the engine running. Before performing the test remove any attachment and block the loader securely with all four wheels clear of the ground.
3. Connect a pressure gauge in the female quick-connect coupling on the auxiliary hydraulic circuit located at the front of the boom arm (fig. 1.3.3a).
4. Start the engine. Set the throttle to obtain 2800 RPM.
5. Press the toe of the auxiliary (center) pedal to activate the auxiliary hydraulic circuit.
6. Pressure must be 2150 PSI (148 BAR) ± 50 PSI (± 3.4 BAR).
7. Shut off the engine and cycle the foot pedal to relieve pressure at the gauge.



ADJUSTMENT — SYSTEM RELIEF VALVE



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.

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

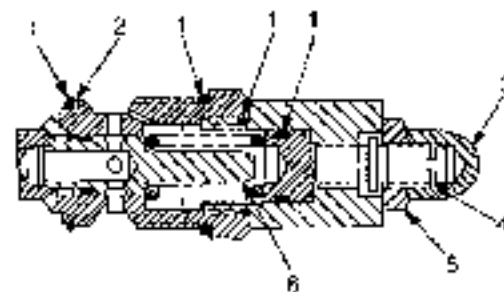


WARNING

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

2. The engine must be run after making any adjustment to check the relief pressure. 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. The pressure gauge, hoses and fittings used should be capable of accepting 3000 PSI (148 BAR) continuous pressure.
4. Remove the seal and the hydrostatic shield.
5. Remove the relief valve assembly from the relief valve (fig. 1.3.3c).

ADJUSTABLE RELIEF VALVE



1. O Ring Seal
2. Back-up Ring
3. Acorn Nut
4. Adjusting Stem
5. Hex Jam Nut
6. Poppet

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Fig. 1.3.3c

6. Loosen the hex jam nut (fig. 1.3.3c).



WARNING

To avoid personal injury do not make any adjustment to the relief valve with the engine running.

7. Using a 5/32 inch allen wrench turn the pressure setting screw a maximum of 1/4 turn. To increase the pressure setting, turn the pressure setting screw in. To decrease, turn the pressure setting screw out.

SECTION 1 HYDRAULICS

8. Tighten the lock nut out.
9. Start the engine. Press the toe of the auxiliary foot pedal to activate the auxiliary hydraulic system, and read the pressure setting on the gauge. Pressure should be 2150 PSI (148 BAR) ± 50 PSI (± 3.4 BAR). Shut off the engine. If necessary repeat steps 6 through 9.

IMPORTANT

Do not set the relief pressure above 2150 PSI (148 BAR) to prevent damage to the hydraulic system components.

10. When the correct relief pressure is obtained tighten the locknut to 15 ft. lbs. (20 N.M.).
11. Install the accumulator and tighten to 15 ft. lbs. (20 N.M.).

1.3.4 Control Valve Removal, Replacement

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.

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.

NOTE: The control valve is more readily accessible from the underside of the loader. To gain access to the control valve from the underside of the loader the belly pan must be removed. Jack up the loader and block securely. Remove bolts securing belly pan and remove.

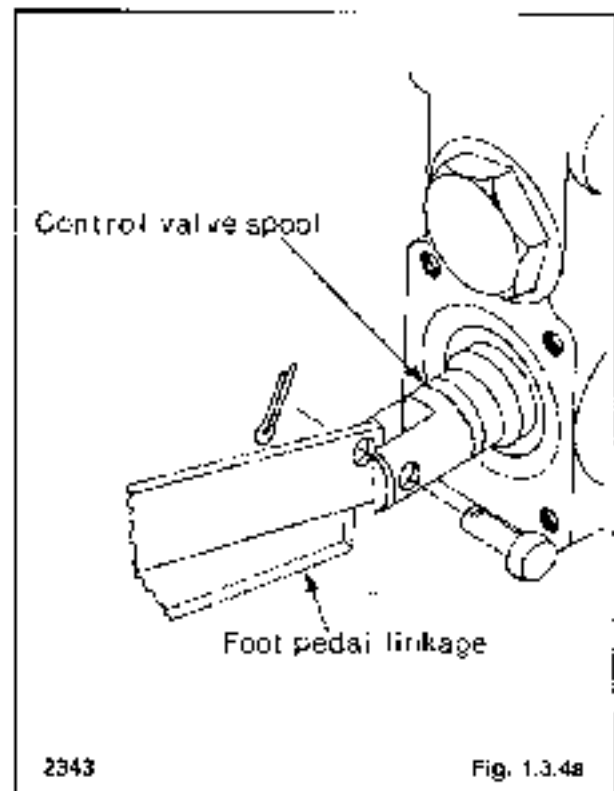


WARNING

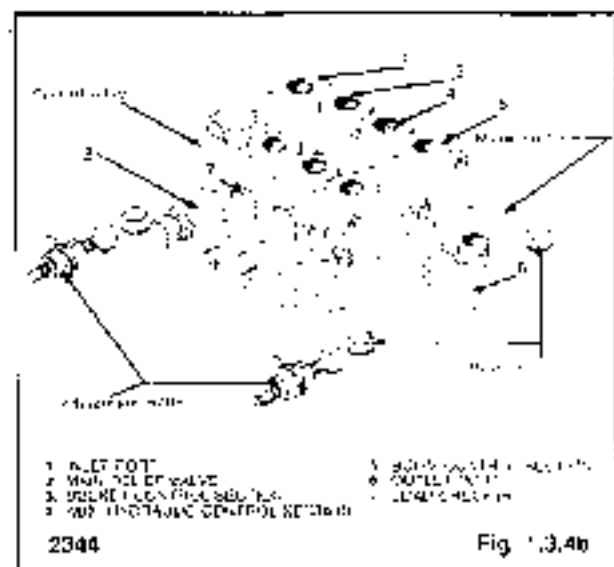
To prevent personal injury never work under a loader unless it is blocked securely.

2. Drain the oil from the hydraulic reservoir. Refer to section 1.8.3.
3. Remove the seat and the hydrostatic shield.

4. Disconnect the foot pedal linkage at the control valve steel (fig. 1.3.4a).



5. 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 inlet port.
6. Disconnect the line from the control valve outlet port (fig. 1.3.4b). Cap the hydraulic line and plug the control valve outlet port.



SECTION 1 HYDRAULICS

7. Disconnect all six lines going to the bucket, boom and auxiliary hydraulic circuits at the control valve. Cap all six hydraulic lines and work parts on the control valve.

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.

8. Back off the adjustment bolts. On reassembly refer to section 4.2.3 for procedure.



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.

9. Remove the four mounting bolts which secure the mounting plate. Remove the control valve and mounting plate from the loader.

On reassembly torque the mounting bolts 12-15 ft. lbs (16-20 N.M).

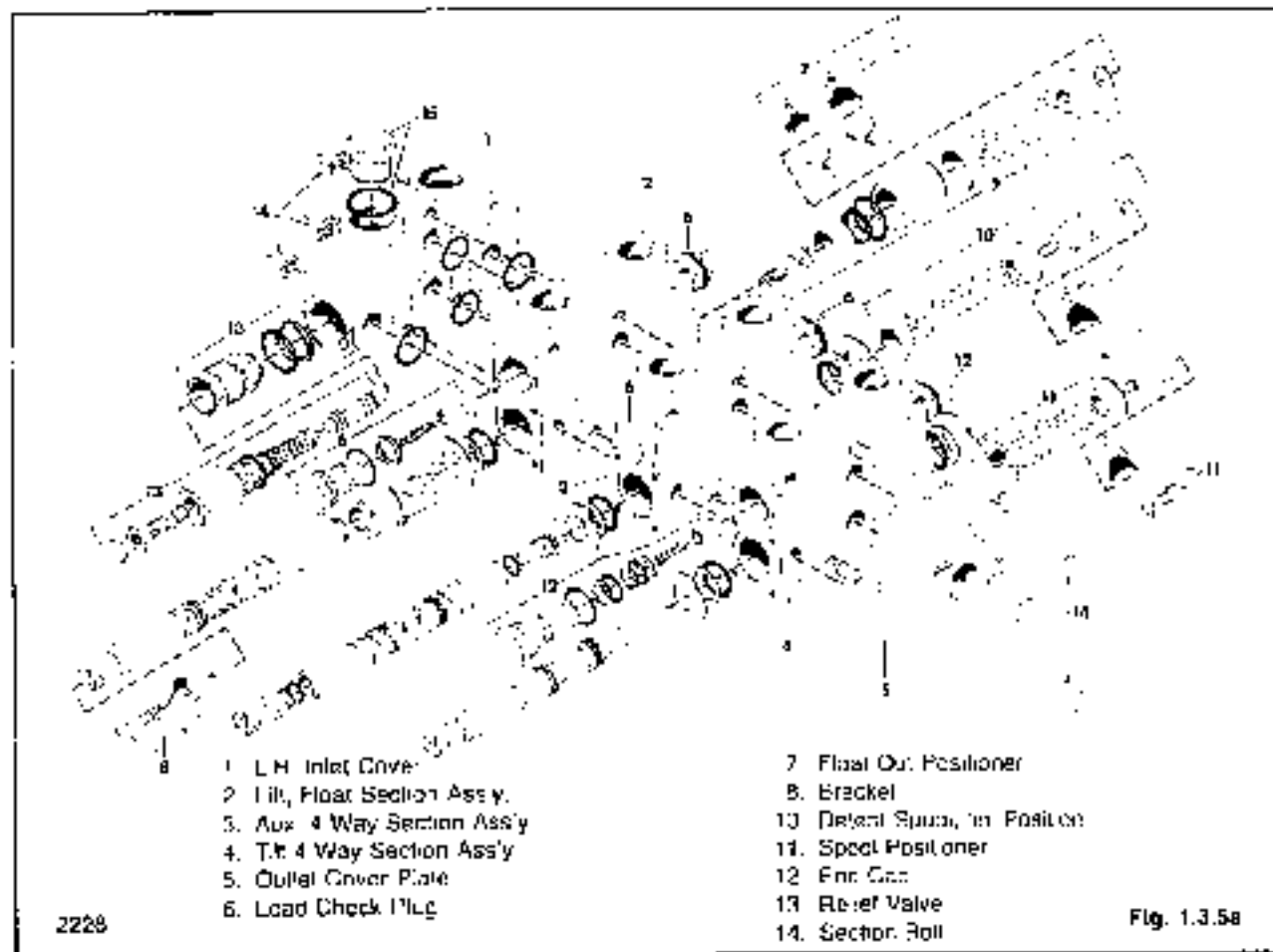
REPLACEMENT—

Replacement generally follows the reverse order of removal.

Before start up fill the hydraulic reservoir to the correct level with 10W50 API classification SE, CD oil. Refer to section 1.8.3 for procedure.

To prevent damage to hydraulic system components refer to start up procedure in section 1.2.6.

1.3.5 Disassembly and Inspection:



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Fig. 1.3.5a

SECTION 1 HYDRAULICS

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 —

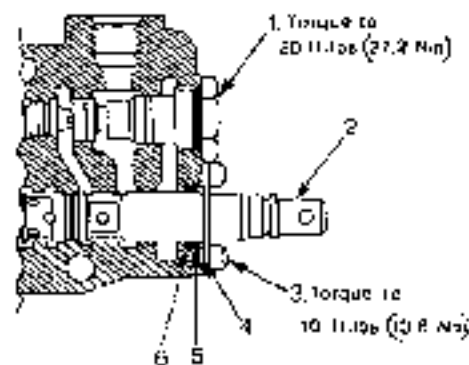
Before disassembling the hydraulic control valve, clean the body with a suitable solvent and dry with compressed air. Ensure all openings are plugged to prevent solvent entering the valve. Refer to figure 1.3.5a to assist in disassembly. Mark each valve section numerically to avoid incorrect assembly.



WARNING

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

VALVE SECTION



1. Load Check Valve
2. Valve Spool
3. Retainer Assembly
4. Plate washer Retainer
5. Back-up Washer
6. O-Ring Seal

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Fig. 1.3.5b

1. Remove the pressure relief valve (1). Discard the 2 O-rings and back-up washer. (Do not disassemble relief valve.)
2. Remove six load check plugs (6), springs and poppets. Discard the back-up washers and O-rings which seal the load check plugs.
3. Remove the two end cap screws from the tilt section (2) end cap (12). Remove the end cap and spacer (12).
4. Remove the two screws from the bracket (8) and remove the bracket and plate washer from the front of the tilt section.
5. Ensure the front of tilt section spool is clean and free of paint.
6. Remove the tilt section spool by grasping the flow rate positioner (7) and gently pull the spool out through the back of the section.
7. Remove the O-ring and metal back-up washer from the front of the spool bore (Fig. 1.3.5b). Discard the O-ring.
8. There is an O-ring and quad-ring inside the collar on the float out positioner (7). To remove slide the collar towards front of spool then back into place.
9. Slide the metal ring from the float out positioner (7) off the spool.
10. Work the quad ring towards front of spool. Remove and discard the quad-ring.
11. Remove the O-ring from collar and discard.

IMPORTANT

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

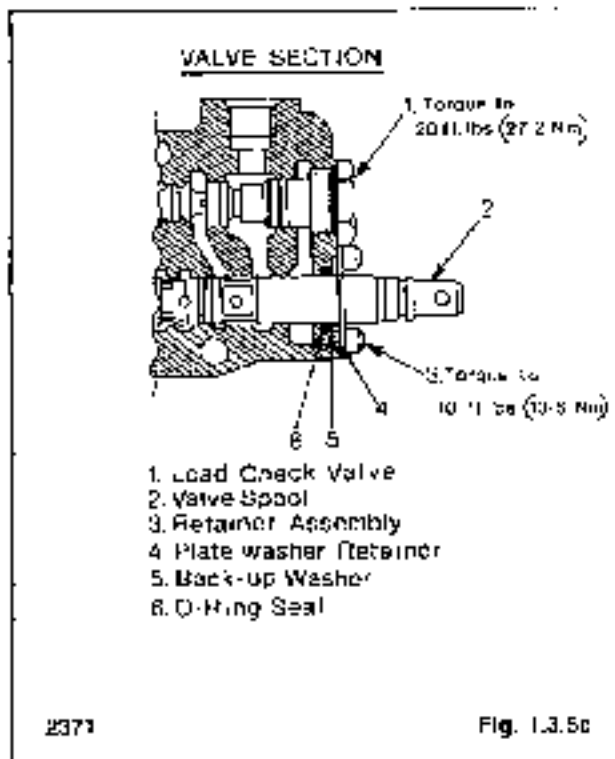
12. Remove the end cap screws from the auxiliary section (3) end cap (12).
13. Remove the retainer plate and retainer plate washer from front of auxiliary section (3).
14. Ensure the front of the auxiliary section is clean and free of paint.
15. Remove the auxiliary section spool by grasping the detent spool positioner (10) and gently pull the spool out through the back of the section.
16. Remove the O-ring and metal back-up washer from the front of the spool bore. Discard the O-ring.
17. Work the O-ring at the back of the spool toward the front. Remove and discard the O-ring.
18. Remove the two end cap screws and remove the tilt section (4) end cap (12).
19. Remove the retainer plate and retainer plate washer from front of tilt section.
20. Ensure front of tilt section spool is clean and free of paint.

SECTION 1 HYDRAULICS

21. Remove the tilt section spool by grasping the spool positioner (11) and gently pull the spool out through the back of the section.
22. Remove the O-ring and metal back-up washer from the front of the spool hole. Discard the O-ring.
23. Work the O-ring towards the front of the spool. Remove and discard the O-ring.
24. Remove the three section bolt nuts (14) from left end of valve using a 5/16" thin wall socket.
25. Remove valve sections by sliding from section bolts (14).
26. Remove and discard O-rings.

INSPECTION —

1. Thoroughly clean and dry all parts.
2. Inspect the load check valve springs for breakage or loss of tension.
3. Inspect the load check poppets for scoring or wear (Fig. 1.3.5c).



4. Inspect the poppet seals inside the valve body for scoring (Fig. 1.3.5c). Sliding on the poppet or poppet seal 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 minimal spool movement.

5. Check the spools for scoring or wear. The spools are selectively fitted to each section. Because of this selective fitting, the spools are not interchangeable or removed individually.
6. Inspect the spool holes in each section for scoring or wear.
7. Check the relief valve and relief valve seat in the control valve housing for scoring or wear.
8. Inspect the O-ring counter bores and ground surfaces of each section.

ASSEMBLY —

1. Replace the four O-rings in each valve section.

NOTE: Use section nuts only with section bolts. **NO LOCK WASHERS!** All bolts are stress proof material and should be replaced only with original equipment replacement parts.

2. Replace valve sections on assembly studs in the same order in which they were removed. O-ring counter bores should be to the left when facing the front of the valve.

NOTE: Use care in replacing valve sections to avoid dislodging O-rings from counter bores.

3. When all valve sections are positioned on section bolts, replace nuts and tighten evenly to 22 ft. lbs. (43 N.M.) torque.

CAUTION: If section bolts are not tightened to the proper torque, valve spools may bind or stick, or cause section seals to extrude.

4. Install new back up washers and O-rings on the six load check plugs (6). Install the load check valves and torque to 23 ft. lbs. (27.2 N.M.) (Fig. 1.3.5c).
5. Lightly oil new O-ring and carefully work it back on the tilt section spool.
6. Carefully insert the tilt section spool into the tilt section (4).

IMPORTANT

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

7. Replace end cap (12) and torque the screws to 10 ft. lbs. (13.6 N.M.).
8. Lightly oil front O-ring and back-up washer. Slide new O-ring over valve spool and insert in seal counterbore. Install metal back-up washer, retainer plate washer and retainer plate. Torque the screws to 10 ft. lbs. (13.6 N.M.) (Fig. 1.3.5c).

SECTION 1 HYDRAULICS

9. Lightly oil new O-ring and carefully work it back on the auxiliary section spool.
10. Carefully insert the auxiliary section into the auxiliary section.
11. Install the end cap and torque the screws to 10 ft. lbs. (13.6 N.M.).
12. Lightly oil new iron O-ring. Slide new O-ring over valve spool and insert in seal counterbore. Install metal back-up washer, retainer plate washer and retainer plate. Torque the screws to 10 ft. lbs. (13.6 N.M.).
13. Lightly oil new quad-ring and carefully work it back over the boom section spool.
14. Use a small allen wrench to seat the quad-ring inside the collar.
15. Install new O-ring in the collar.
16. Slide the metal ring back over the spool and into the collar.
17. Carefully insert the lift section spool into the lift section.
18. Replace spacer and end cap (12). Torque end cap screws to 10 ft. lbs. (13.6 N.M.).
19. Lightly oil new iron O-ring. Slide the new O-ring over valve spool and insert in seal counterbore. Install metal back-up washer, retainer plate washer, and retainer plate. Torque the screws to 10 ft. lbs. (13.6 N.M.).
20. Insert the new rear relief O-ring into the inlet cover (1). Ensure the O-ring is seated firmly in the seal counterbore.
21. Install new back-up washer and front O-ring on the relief valve (Fig. 1.3 5d).

22. Install the relief valve and torque to 20 ft. lbs. (27.2 N.M.)

1.3.8 Spool Seal Replacement:

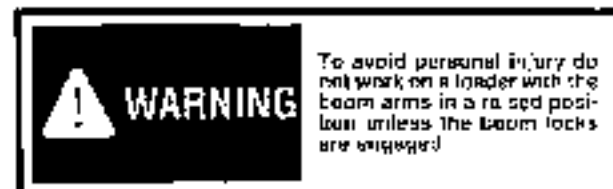
It is not necessary to remove the hydraulic control valve from the loader or to remove the spools from the valve body to replace the spool seals.

The following instructions refer to replacement of the spool seals on the lift section. The procedure on the other two sections is the same with the exception of the boom section spool, which has a collar on the float out positioner with a collar seal and O-ring. Refer to section 1.3.5 for additional information.

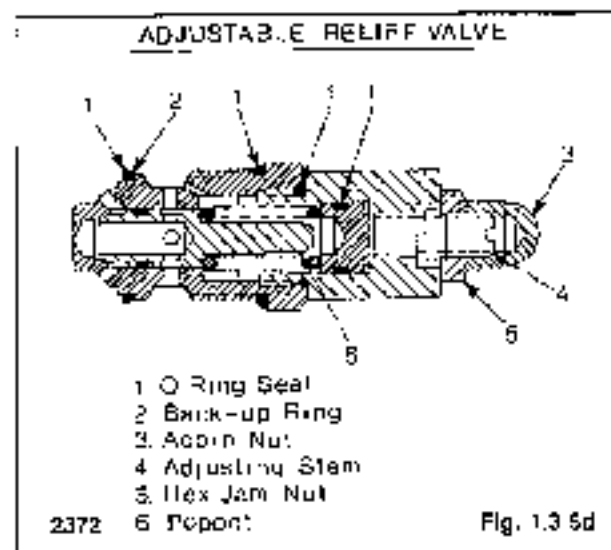
The control valve is more readily accessible from the underside of the loader. To gain access to the control valve from the underside of the loader the belly pan must be removed. Jack up the loader and block securely. Remove bolts securing belly pan and remove.



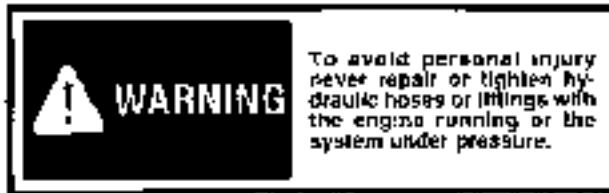
1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.



2. Remove the seal and the hydraulic shield and belly pan.

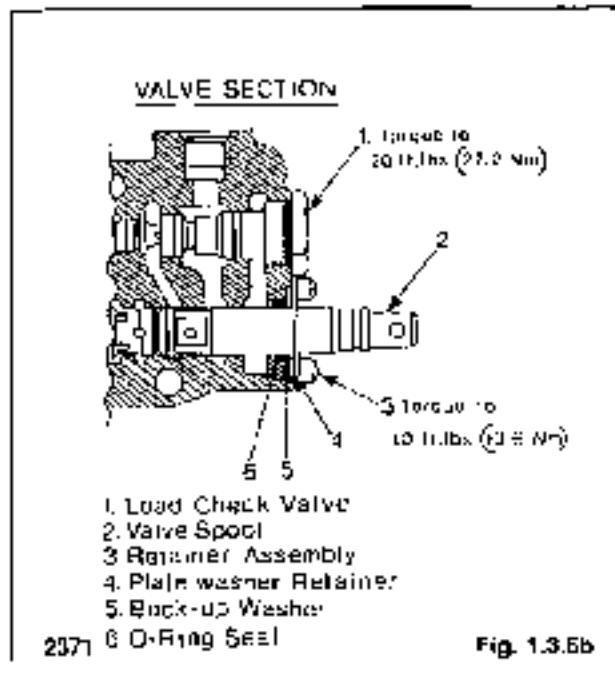
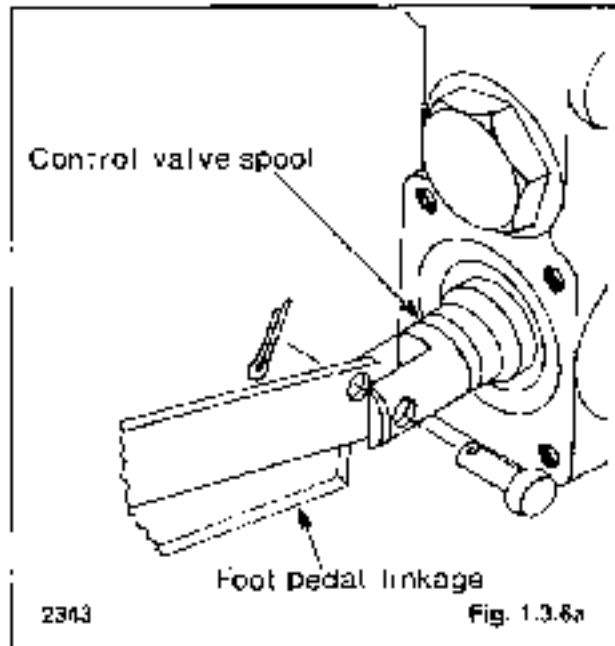


SECTION 1 HYDRAULICS



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

3. Disconnect the foot pedal linkage at the control valve spool (fig. 1.3.6a).



4. Remove the two end cap screws and remove the fill section end cap.
5. Remove the retainer plate and retainer plate washer from front of fill section.
6. Ensure front of fill section spool is clean and free of paint.
7. Remove the fill section spool by grasping the spool positioner and gently pull the spool out through the back of the section.
8. Remove the O-ring and metal back-up washer from the front of the spool bore. Discard the O-ring.
9. Work the O-ring towards the front of the spool. Remove and discard the O-ring.
10. Lightly oil new O-ring and carefully work back on the fill section spool.
11. Carefully insert the fill section spool into the fill section.

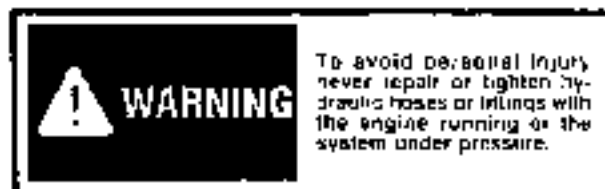


Do not intermix parts from one spool with another. Keep spool parts separate.

12. Replace end cap and torque the screws to 10 ft. lbs. (13.6 N.M.).
13. Lightly oil front O-ring and back-up washer. Slide new O-ring over valve spool and insert in seal counterbore. Install metal back-up washer, retainer plate washer and retainer plate. Torque the screws to 10 ft. lbs. (13.6 N.M.) (fig. 1.3.6b).
14. Reinstall the belly pan.
15. Reconnect the foot pedal linkage.
16. Start the engine and check for leaks.



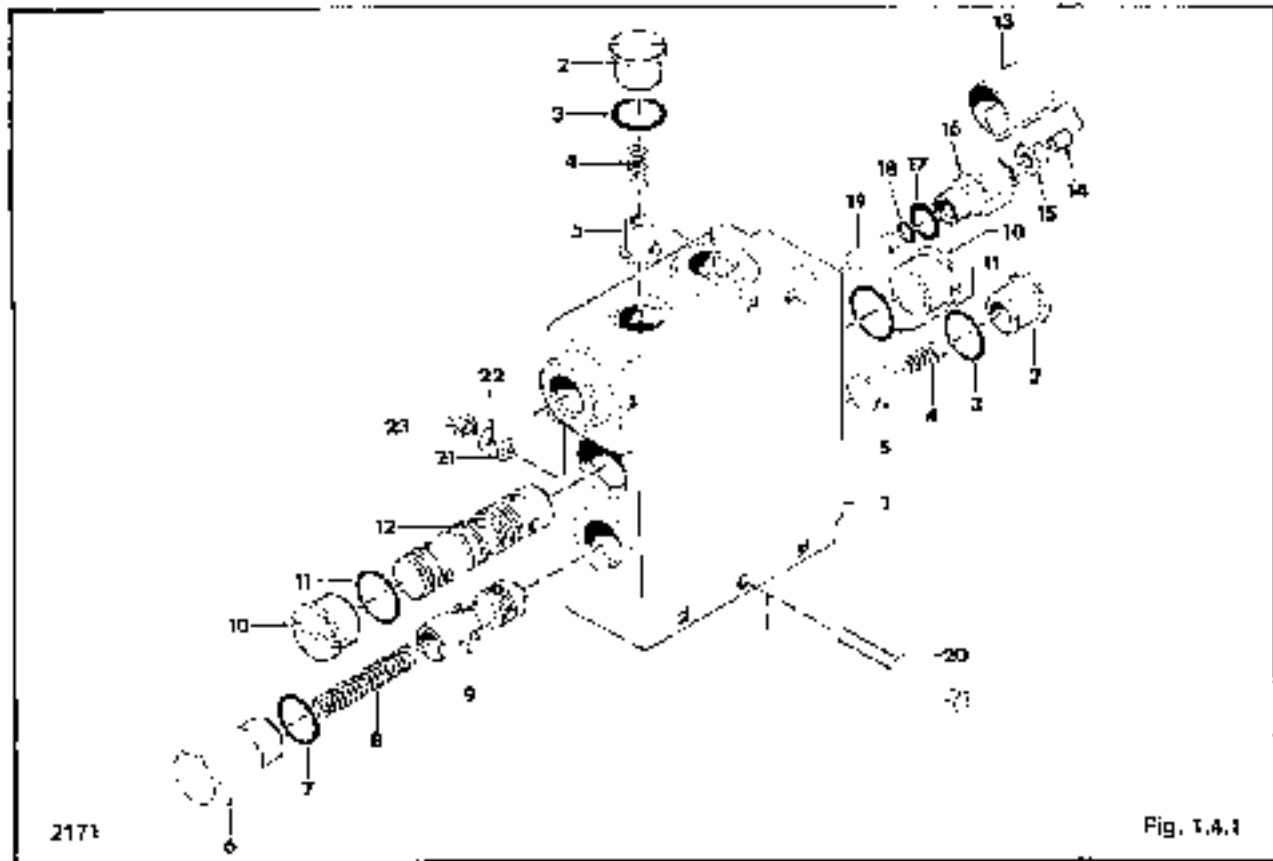
To avoid personal injury do not start the engine unless you are in the seat with the seat belt fastened around you.



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

SECTION 1 HYDRAULICS

1.4 SELF-LEVEL VALVE T233HD



1.4.1 Specifications:

Circuit design	In line self-level
Inlet flow rate	15 GPM (56.6 l/min.)
Rated pressure	3000 PSI (207 Bar)
Maximum pressure	4000 PSI (276 Bar)
Standard flow divider setting Port D	80%
Standard flow divider setting Port B	40%
Flow divider setting Port D	Adjustable 0% to 75%
Flow divider setting Port B	Proportional from 25% to 100%
Maximum system temperature	225° F (107°C)

PORT FUNCTIONS

- Port A — Connected to boom cylinder rod port — boom lower
- Port B — Connected to control valve — boom lower
- Port C — Connected to bucket rod port and feed to control valve work port — bucket dump
- Port D — Connected to bucket cylinder head port and feed to control valve work port — bucket dump

1.4.2 General Information:

The inline self-level valve is mounted inside the engine compartment on the left side.

As with all hydraulic self-level valves, the self-level feature only works during the upward cycle. Manual correction of the bucket angle must be made using the bucket foot pedal control on the down cycle.

1.4.3 Adjustment:

1. Start the loader and allow the engine to warm up for five minutes before operating. Lower the seat air and advance the throttle to full on position.

WARNING

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

2. With the boom fully down level the bucket.

IMPORTANT

Fully retract pins before raising or lowering bucket arms.

SECTION 1 HYDRAULICS

3. Raise the boom and observe whether the bucket remains level during the upward cycle. If during upward operation the bucket does not remain level adjustment to the hydraulic self-level valve is necessary.



WARNING

To prevent personal injury do not operate the loader without lowering the seat bar, fastening the seat belt and keeping feet on the control pedals.

4. Determine which way the bucket tilts during upward operation of the boom.
5. Lower lift arms, ground bucket and shut off the engine.



WARNING

To avoid personal injury stop the engine, lower the boom arms and engage the parking brake and check that the foot pedals are locked before getting out of loader.

6. Open rear door. Remove the cover from the adjustment cap on the rear of the self-level valve. See fig. 1.4.3a.

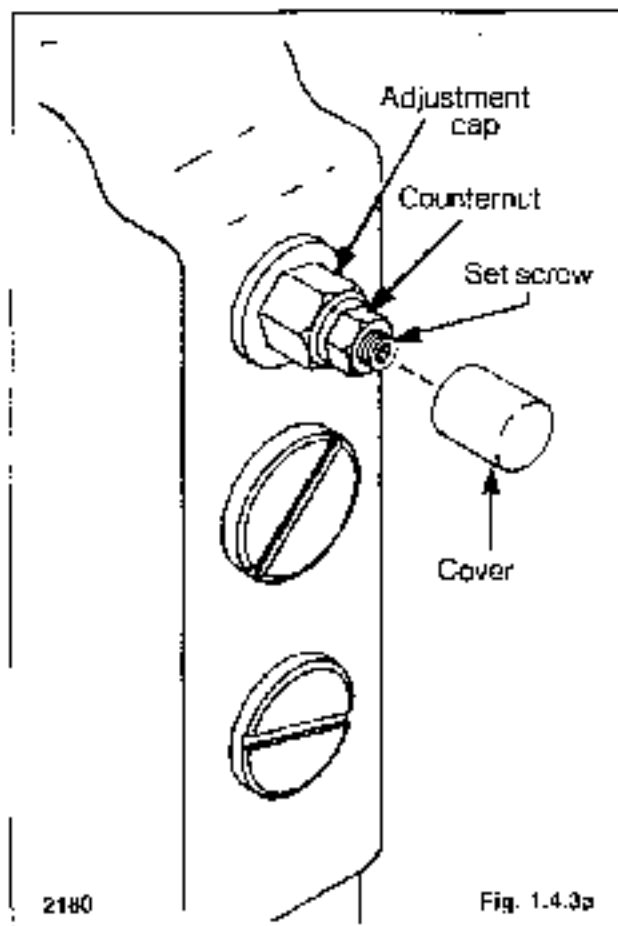


Fig. 1.4.3a

WARNING

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

7. Turn adjustment screw "in" or "clockwise" a slight amount if bucket tilts down during upward operation of the boom. See fig. 1.4.3b.

Turn adjustment screw "out" or "counter-clockwise" a slight amount if the bucket tilts up during upward operation of the boom. See fig. 1.4.3b.

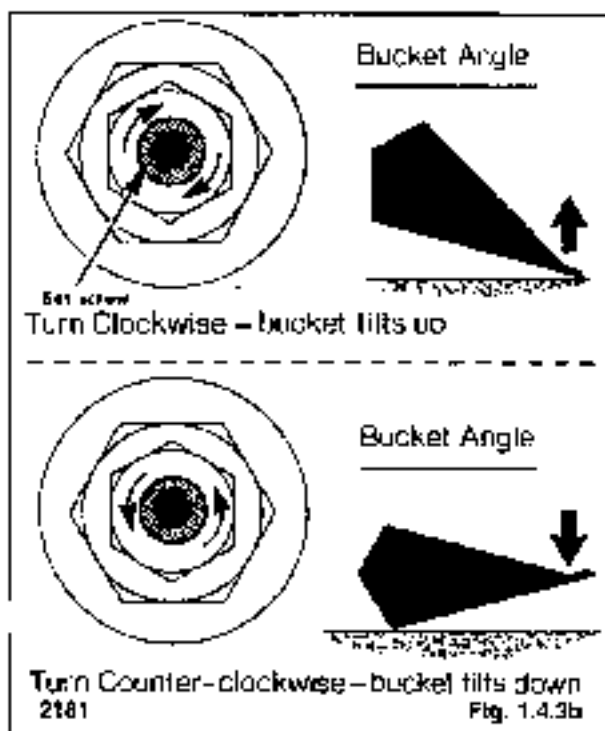


Fig. 1.4.3b

WARNING

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

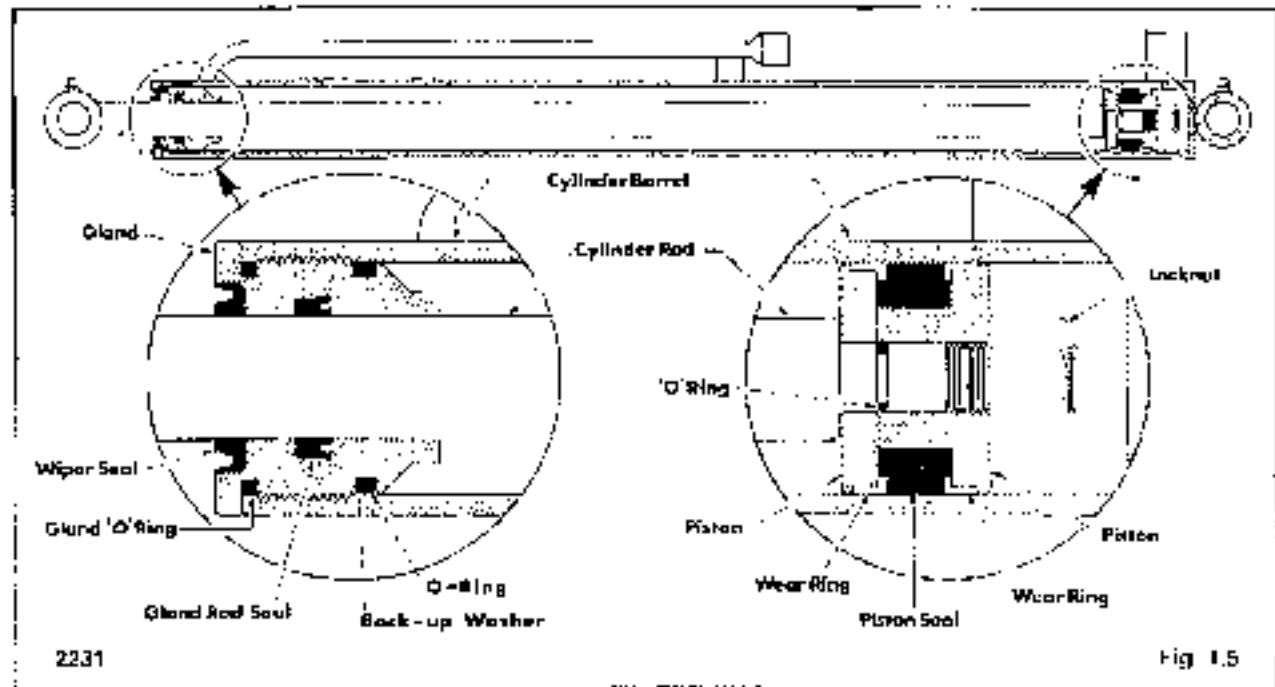
8. After adjustment, tighten the counternut, replace the cover on the adjustment cap and test self-leveling circuit. If necessary repeat steps 1 through 8.

IMPORTANT

Keep the rear door closed except for servicing. Make sure the door is closed and latched before operating the loader.

SECTION 1 HYDRAULICS

1.5 HYDRAULIC CYLINDERS



1.5.1 Specifications:

	T1B3HD	
Cylinders (double acting)	Lift	Tilt
Bore dia.	2.5 in.	3.0 in.
Rod dia.	1.5 in.	1.5 in.

	T233HD	
Cylinders (double acting)	Lift	Tilt
Bore dia.	3 in.	2.5 in.
Rod dia.	2 in.	1.5 in.

Rated at 2150 P.S.I. (148 Bar)

CYCLE TIMES (sec.)	T1B3HD	T233HD
Boom up	4.0	6.7
Boom down	2.5	2.5
Bucket dump	3.0	3.0
Bucket rollback	2.5	2.5
Total cycle time	7.5	11.3

With engine at rated RPM — 2000

1.5.2 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 chrome plated. The cylinder barrels are micropolished 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.

Three types of outer gland seals are used. The first type consists of an O-ring with a nylon back-up washer installed on the low pressure side of the O-ring. The second type consists of an O-ring which seals between the gland and the end of the cylinder barrel. The third type contains both of the above seal arrangements. The seal kit contains seals to service all types of glands.

1.5.3 Testing, Piston Seals:

If the boom or bucket cylinders will 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 boom completely down. Shut off the engine and cycle the foot pedals to release hydraulic pressure.

SECTION 1 HYDRAULICS



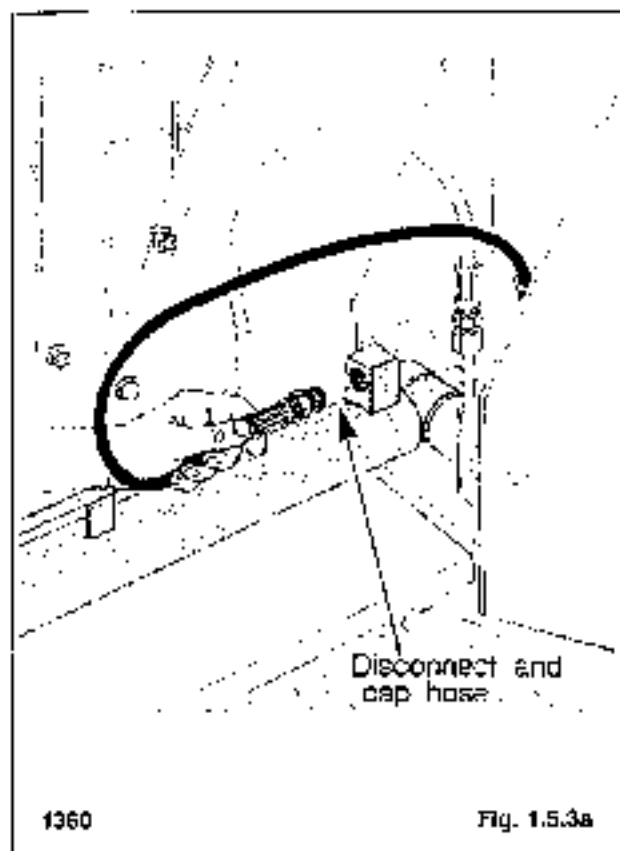
WARNING

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

3. Disconnect the hydraulic hose from the boom cylinder rear port (fig. 1.5.3a). Cap the hose.

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.



4. Start the engine. Push down on the top of the boom foot control pedal (do not put in foot position).
5. If oil leaks from the rear boom cylinder port, remove the cylinder or cylinders and make repairs as needed (see section 1.5.4 and 1.5.5). 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.

BUCKET CYLINDERS:

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



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. Extend the bucket cylinders full stroke. Shut off the engine. Cycle the foot pedals to release hydraulic pressure.
3. This test must be performed with the engine running. Block the loader securely with all four wheels clear of the ground.



WARNING

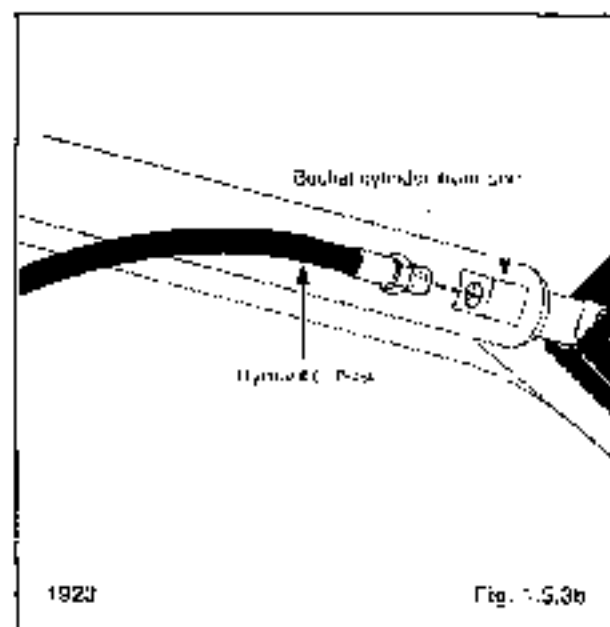
To avoid personal injury never repair or tighten hydraulic hoses or fittings with engine running or the system under pressure.

4. With the engine off, disconnect the hydraulic hose from the bucket cylinder front port (fig. 1.5.3b). Cap the hose.



WARNING

To avoid personal injury do not stand or allow anyone to stand under the boom arms while performing this test.



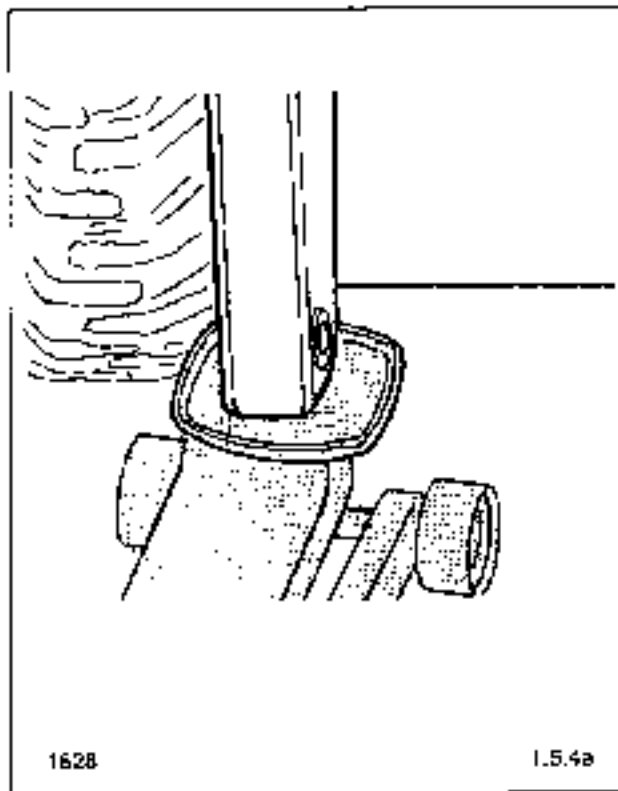
SECTION 1 HYDRAULICS

5. Start the engine. Push down on the toe of the bucket foot control pedal.
6. If oil leaks from the front bucket cylinder port, remove the cylinder or cylinders and make repairs as needed (see section 1.5.4 and 1.5.5).
If there is no leakage from the front bucket cylinder port, check for internal leakage at the control valve (see section 1.3.5).
7. Shut off the engine. Reconnect the hydraulic hose to the front bucket cylinder port.

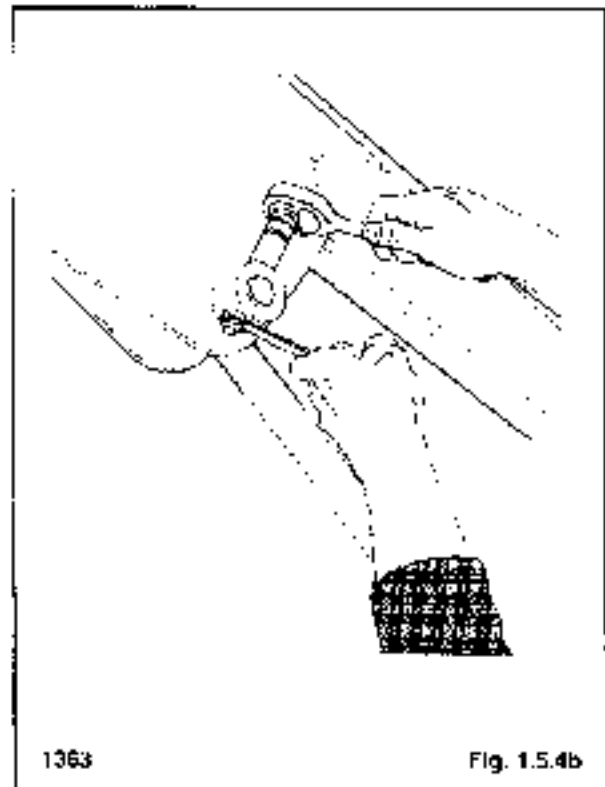
1.5.4 Cylinder, Removal:

BOOM CYLINDER — REMOVAL

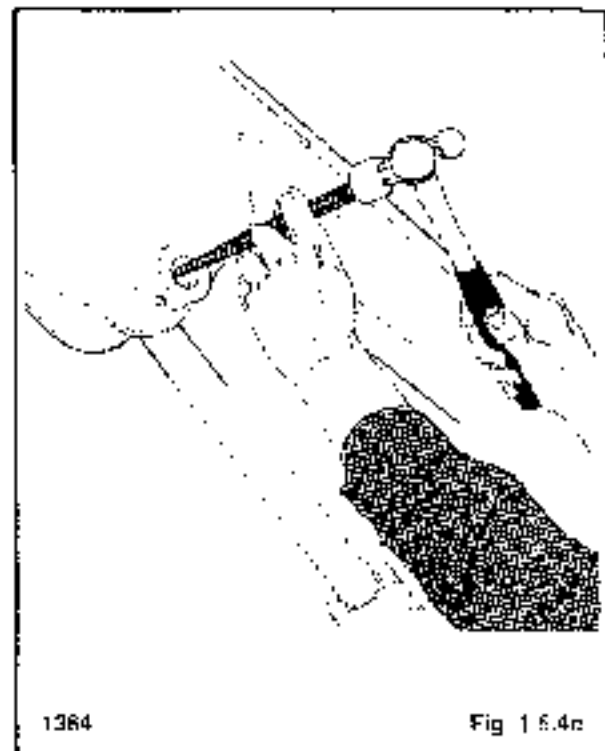
1. Stop the engine and cycle the foot pedals to relieve any hydraulic pressure in the system.
2. Put a floor jack under the boom arms (fig. 1.5.4a).



3. Lock the bucket lift 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. 1.5.4b).

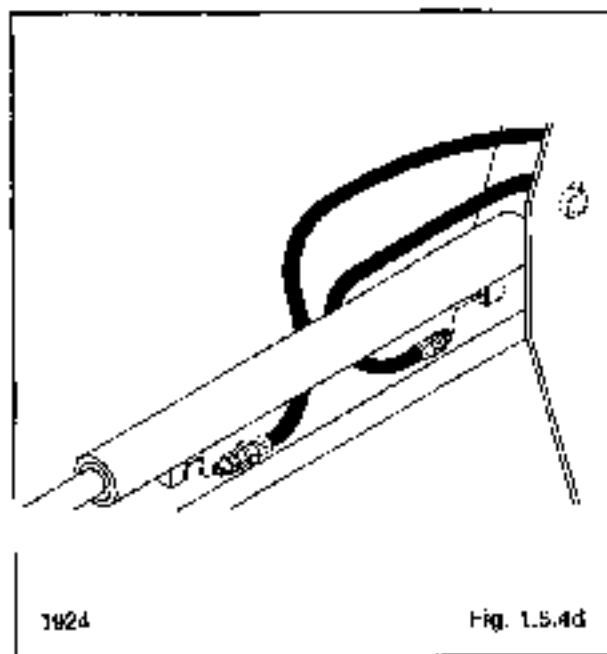


6. Remove the pivot pins (fig. 1.5.4c). Place a support under the boom cylinder to prevent the cylinder from falling when the pivot pin is removed.

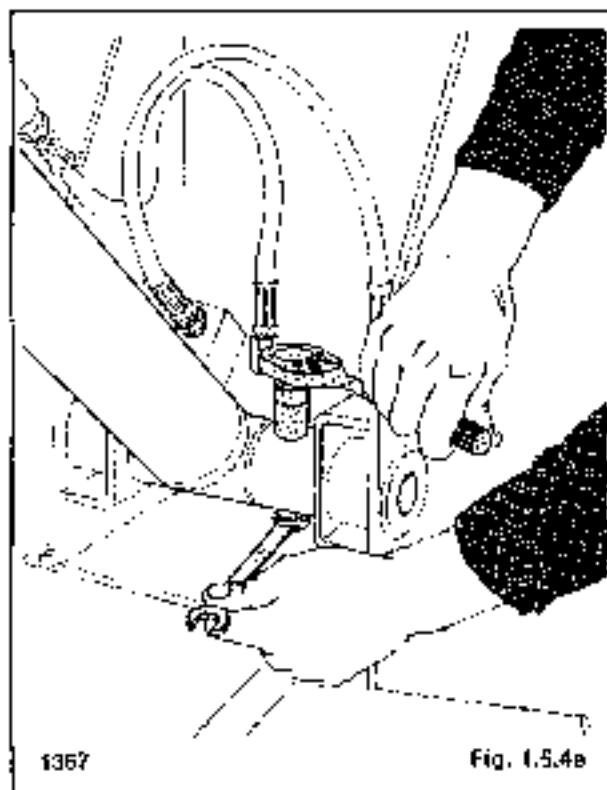


SECTION 1 HYDRAULICS

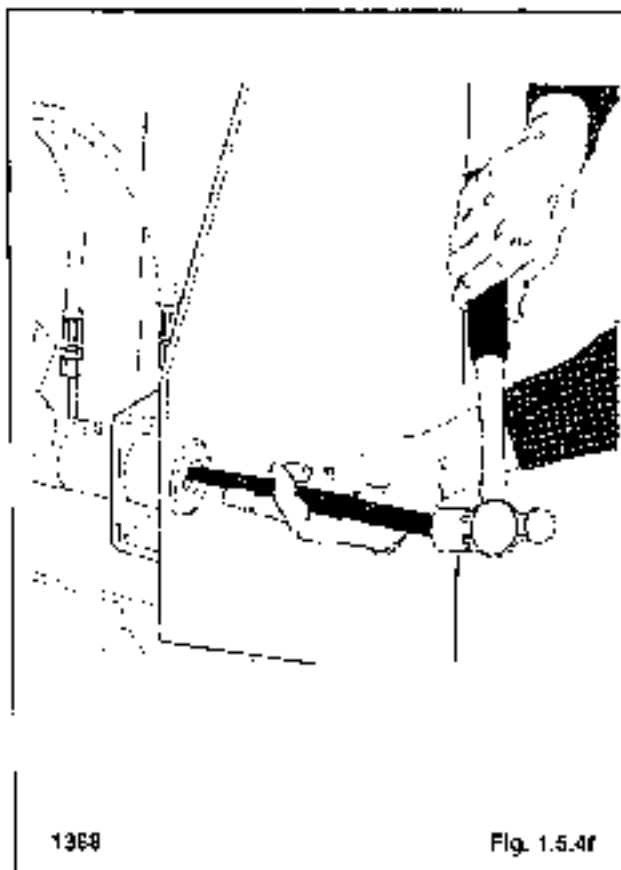
7. Remove the hydraulic hose from the front and rear ports on the boom cylinder (fig. 1.5.4d). Cap cylinder ports and hoses.



8. Remove the locknut, washer and bolt at the base of the cylinder (fig. 1.5.4e).



9. Remove the pivot pin (fig. 1.5.4f).



10. Remove the boom cylinder from the leader.
11. Lower the boom arms and remove the floor jack.

BUCKET CYLINDER -- REMOVAL

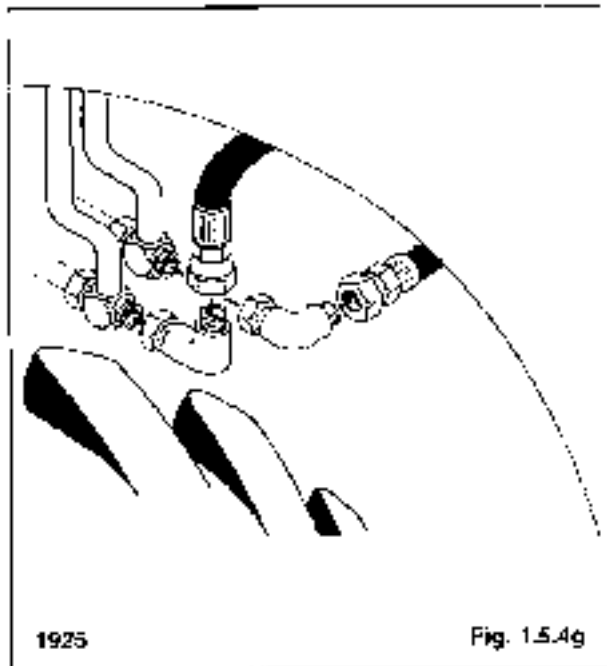
1. Lower the boom arm, remove any attachment and extend the bucket cylinders until the top edge of the quick-tach frame is resting on the ground.

Shut off the engine. Cycle the hydraulic pedals to release any pressure.

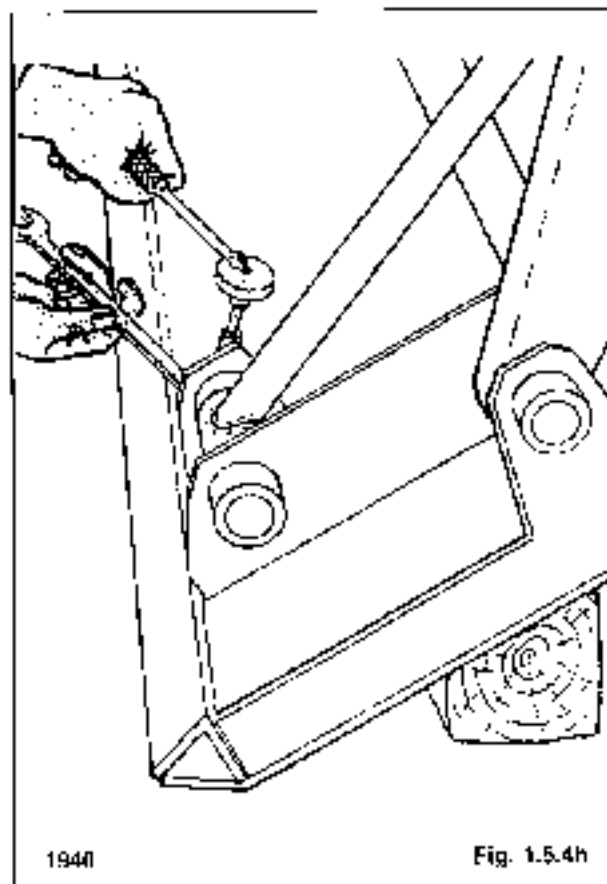
2. Disconnect the hydraulic lines from the bucket cylinder (fig. 1.5.4g).

Cap the cylinder hoses and the hydraulic fittings.

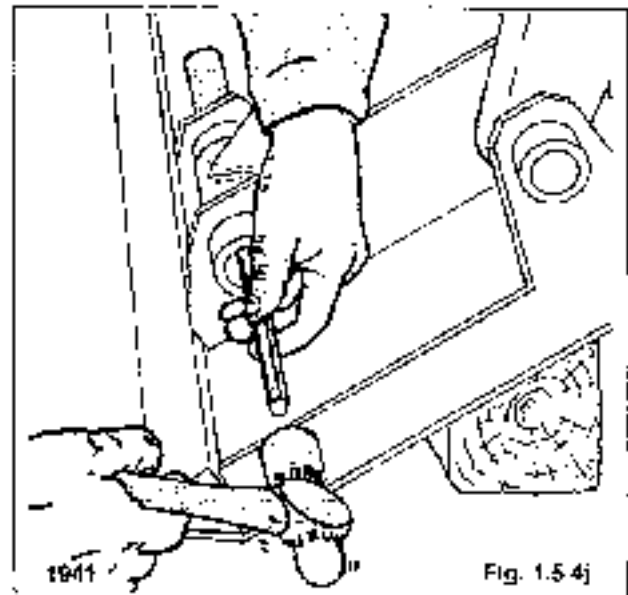
SECTION 1 HYDRAULICS



3. Remove the locknut, washer and bolt at the rod end of the cylinder (fig. 1.5.4h).



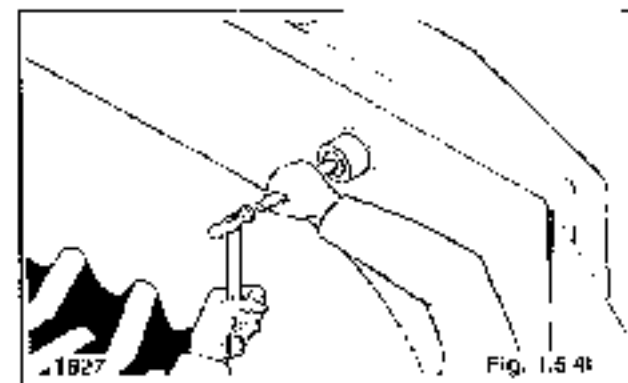
4. Remove the pivot pin (fig. 1.5.4i).



5. Remove the locknut, washer and bolt at the rear bucket cylinder bushing (fig. 1.5.4k).



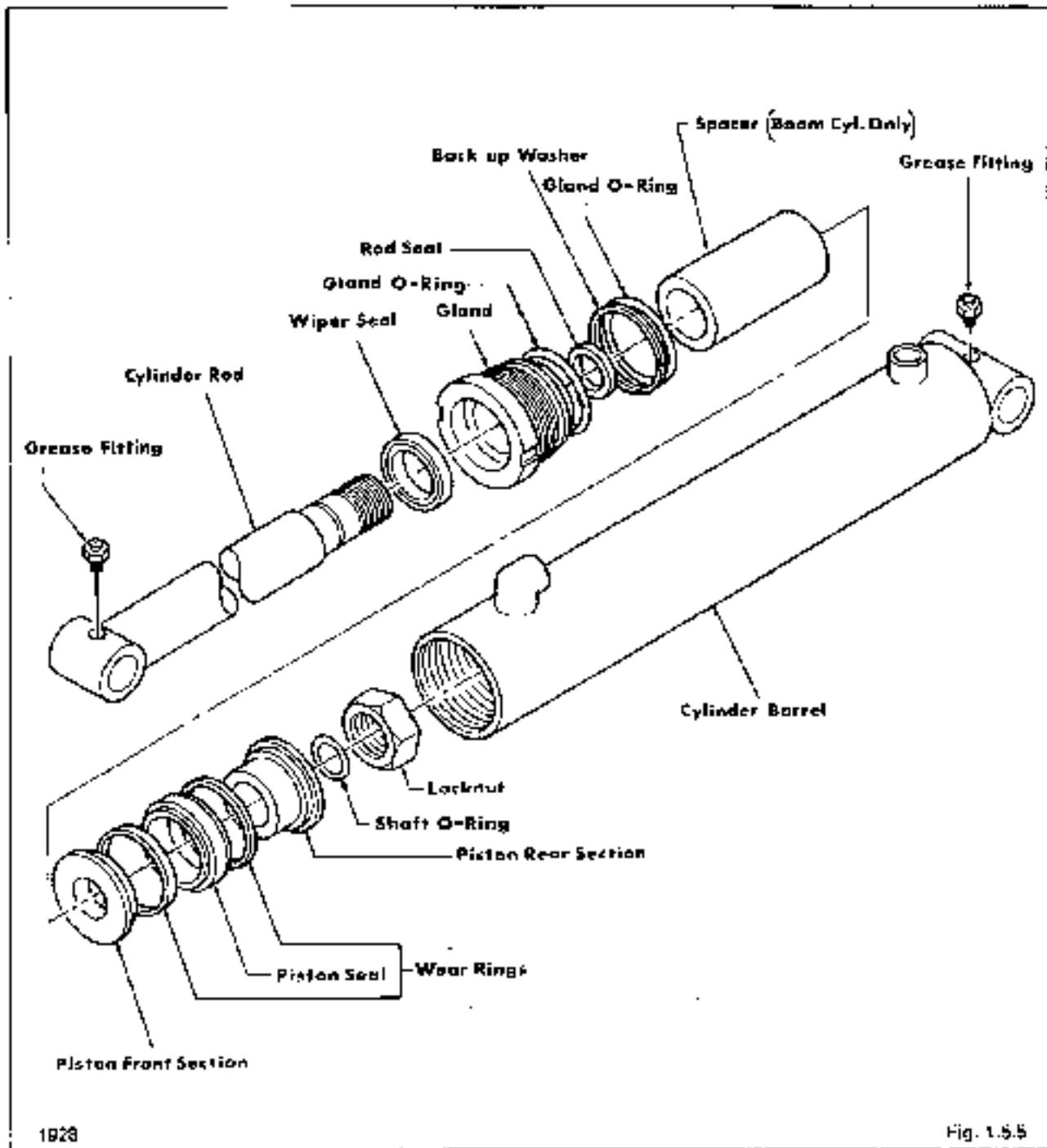
6. Support the bucket cylinder to prevent it from falling and remove the pivot pin (fig. 1.5.4l).



7. Remove the cylinder from the loader.

SECTION 1 HYDRAULICS

1.5.5 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.

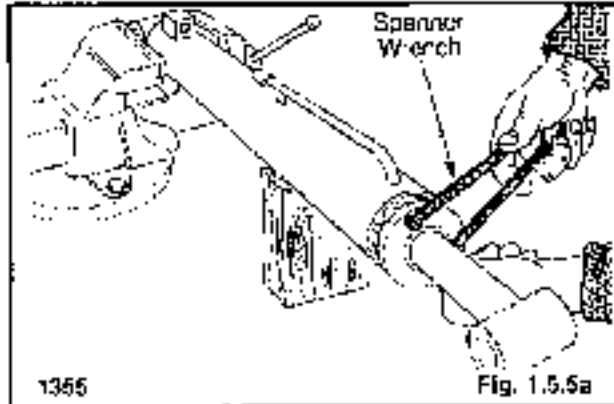
IMPORTANT

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.

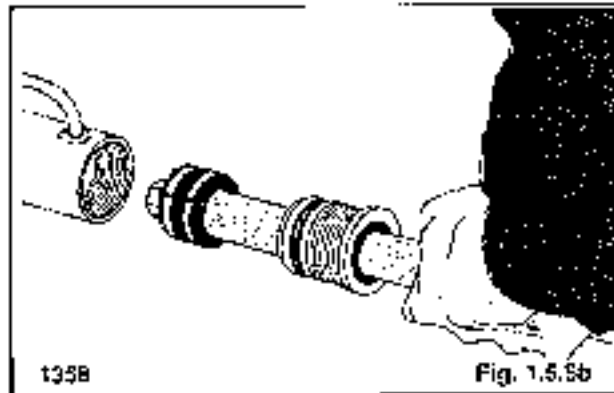
SECTION 1 HYDRAULICS

DISASSEMBLY:

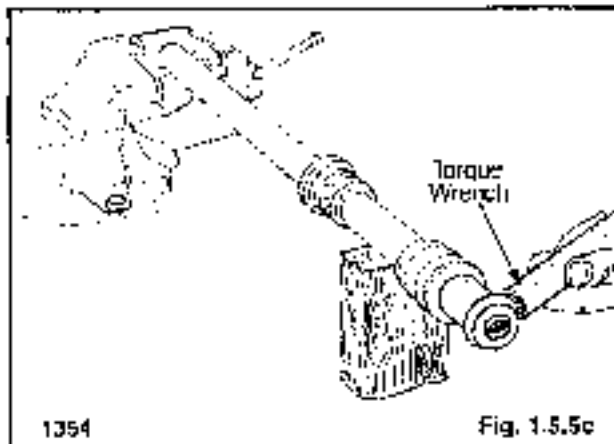
1. Place the base end of the cylinder in a vice and support the front end of the body (fig. 1.5.5a). Remove the plugs from the hose ports.
2. Using a spanner wrench, unscrew the gland from the cylinder barrel (fig. 1.5.5a).



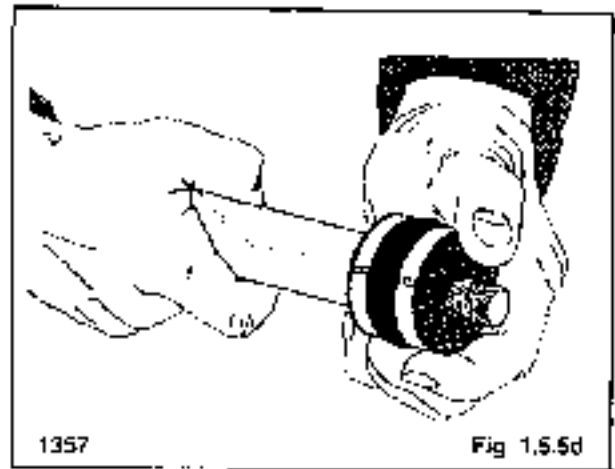
3. Remove the rod, gland and piston assembly from the cylinder barrel (fig. 1.5.5b).



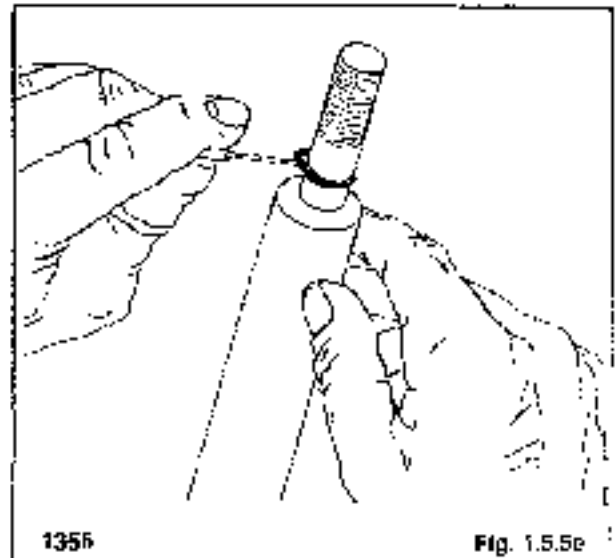
1. Place the rod end in a vice and remove the nut (fig. 1.5.5c).



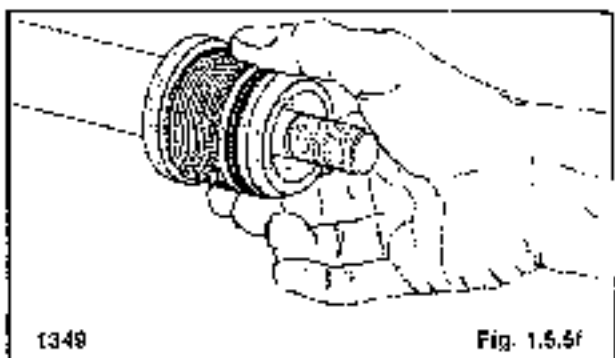
5. Remove two piece piston assembly from the cylinder rod (fig. 1.5.5d).



6. Remove and discard the O-ring from the end of the cylinder rod (fig. 1.5.5e).

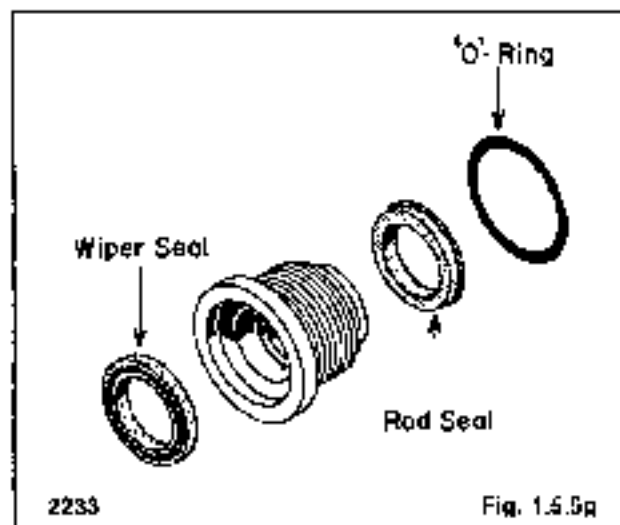


7. Remove the gland assembly from the cylinder rod (fig. 1.5.5f).

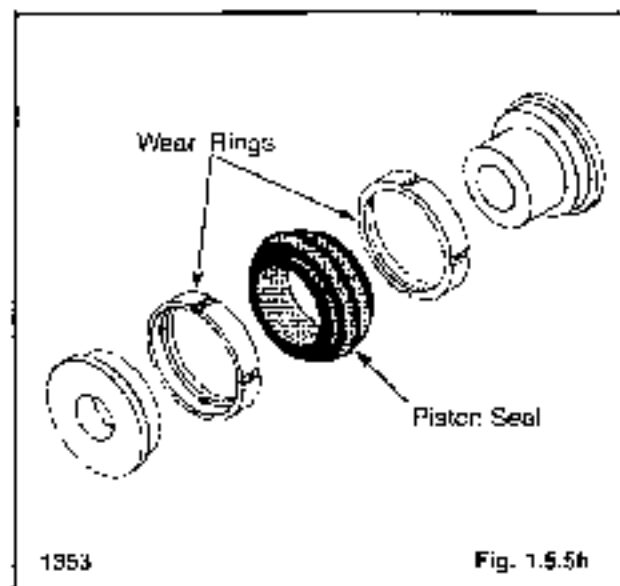


SECTION 1 HYDRAULICS

8. Remove and discard the wiper seal, rod seal and O-rings and left-hand back-up washer from the gland assembly (fig. 1.5.5g).



9. Remove and discard the wear rings and piston seal from the piston assembly (fig. 1.5.5h).

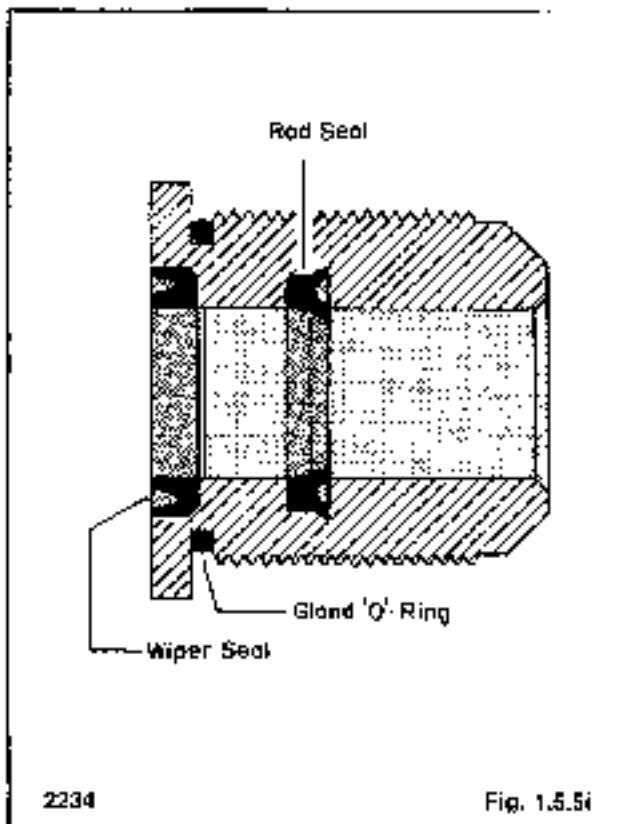


INSPECTION

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.

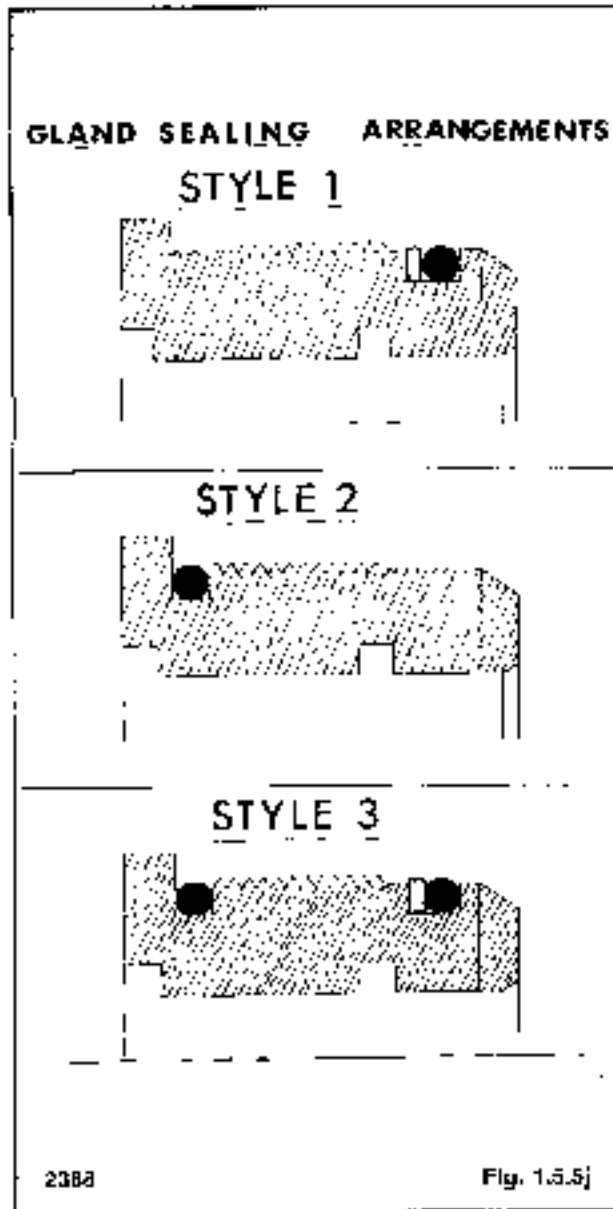
ASSEMBLY

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. 1.5.5i).
2. Install a new rod wiper seal in the gland (fig. 1.5.5j).



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3. Three types of gland sealing arrangements have been used on the boom lift and bucket tilt cylinders (fig. 1.5.j).



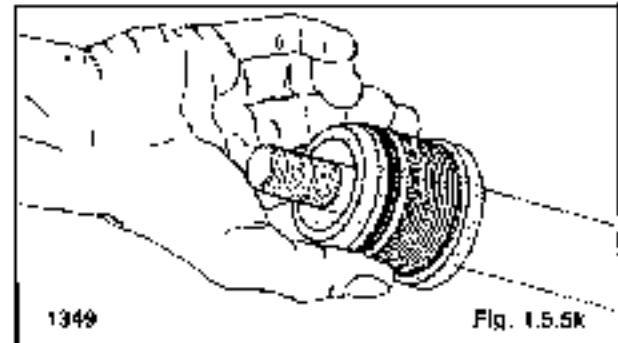
4. Assemble each as follows:

STYLE 1 — Install a new gland O-ring and back-up washer. Ensure the back-up washer is on the rod end side (low pressure side) of the O-ring (fig. 1.5.j).

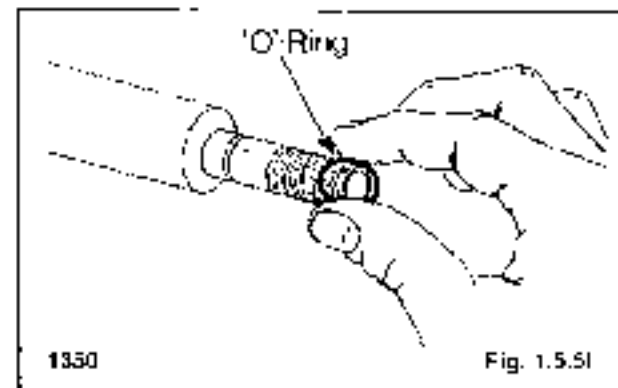
STYLE 2 — Install a new gland O-ring (fig. 1.5.j).

STYLE 3 — Install two new gland O-rings and back-up washer. Ensure the back up washer is on the rod end side (low pressure side) of the O-ring (fig. 1.5.j).

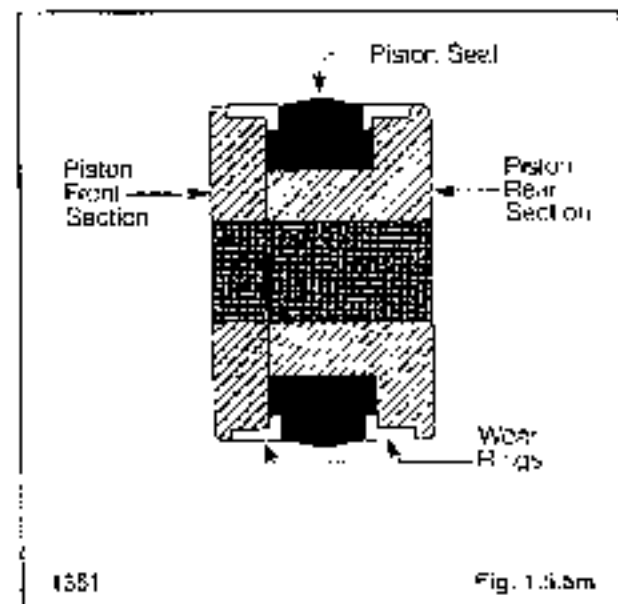
5. Coat the cylinder rod with light oil and assemble the gland assembly (fig. 1.5.k) on the rod.



6. Install a new O-ring on the cylinder rod (fig. 1.5.l).

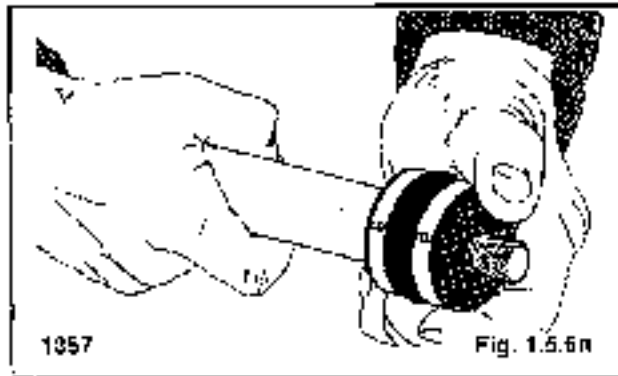


7. Install new wear rings and piston seal on the two piece piston assembly (fig. 1.5.m).

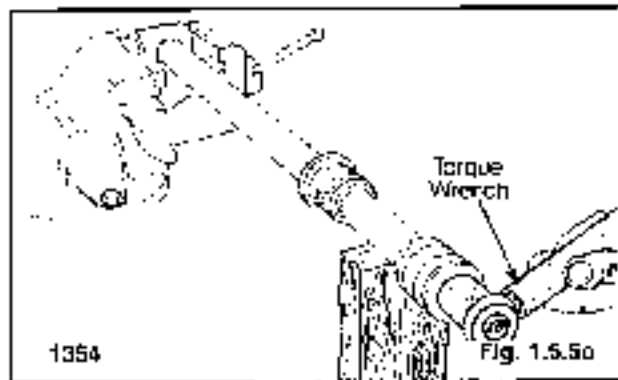


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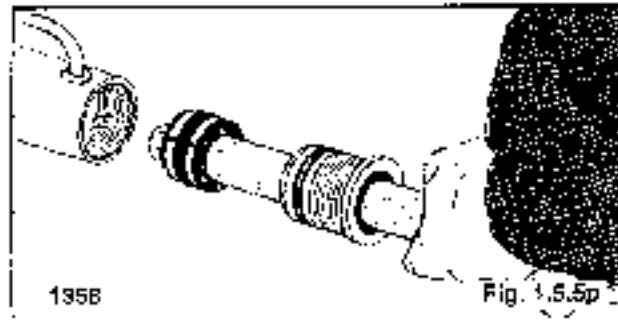
8. Install the piston assembly on the cylinder rod (fig. 1.5.5n).



9. Place the cylinder rod in a vice and install the nut. Torque the nut to 175-200 ft. lbs. (237-271 N.M.); (fig. 1.5.5o).



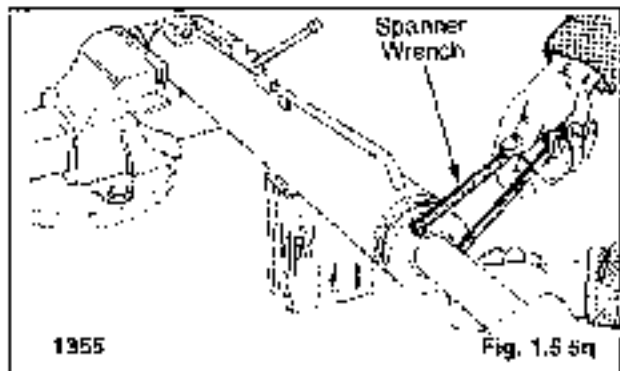
10. Coat gland and piston seals with light oil. Install the cylinder rod assembly in the cylinder barrel (fig. 1.5.5p).



11. Clean and degrease the gland threads and the cylinder barrel threads by spraying with Loctite Primer T (Loctite product no. 74758). Allow the parts to dry 5 minutes.
12. Carefully apply Loctite Medium Strength Adhesive Sealant 242 (Loctite product no. 242-31), to the gland threads. Apply a SMALL drop of Loctite 242 on the center of the gland threads. Turn the gland 180 degrees and apply another SMALL drop of Loctite.



13. Place the cylinder body in a vice and using a spanner wrench tighten the gland (fig. 1.5.5c).
14. Cap the hose port openings on the cylinder body until the cylinder is reinstalled on the loader.



1.6 HYDRAULIC OIL FILTER

1.6.1 Specifications:

Filter type	replaceable element
Filtration rating	10 micron
Filtration prep	.800 sq. in. (5161 cm ²)
Relief valve setting	17-19 PSI (1.2-1.3 BAR)
Case capacity	1.5 qts. (1.4 l)
Max. operating pressure	250 PSI (17.2 BAR)
Max. operating temperature	250°F (121°C)
Case torque	.30 ft. lbs. (41 N.M.)
Initial filter replacement	50 hrs.
Filter replacement (every)	150 hrs.

1.6.2 General Information:

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

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 accordion pleated design to provide maximum filtering area. A bypass relief valve built into the replaceable element diverts oil from the filter when more than 17-19 PSI (1.2-1.3 BAR) differential pressure is required to force oil through the element.

1.6.3 Filter Replacement:

The hydraulic filter must be changed after the first 50 hours of operation and every 150 hours thereafter. Clean the filter case with a suitable solvent before disassembly.

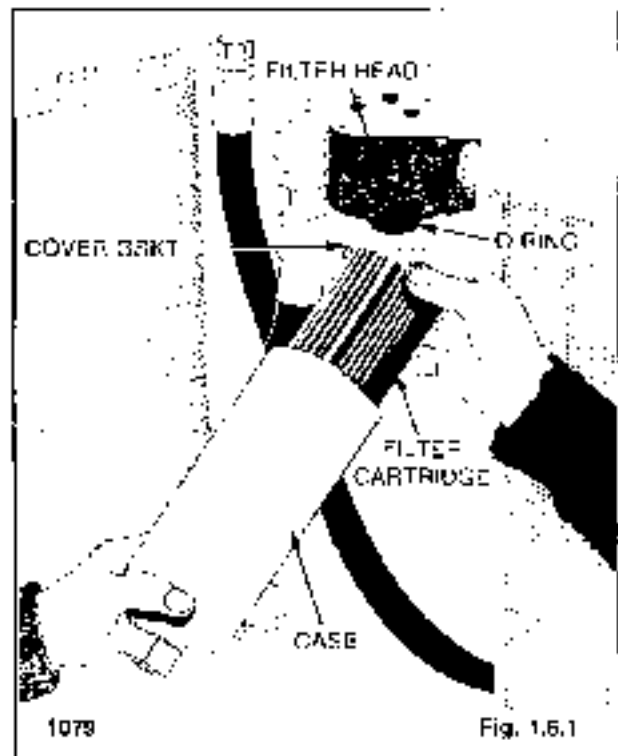
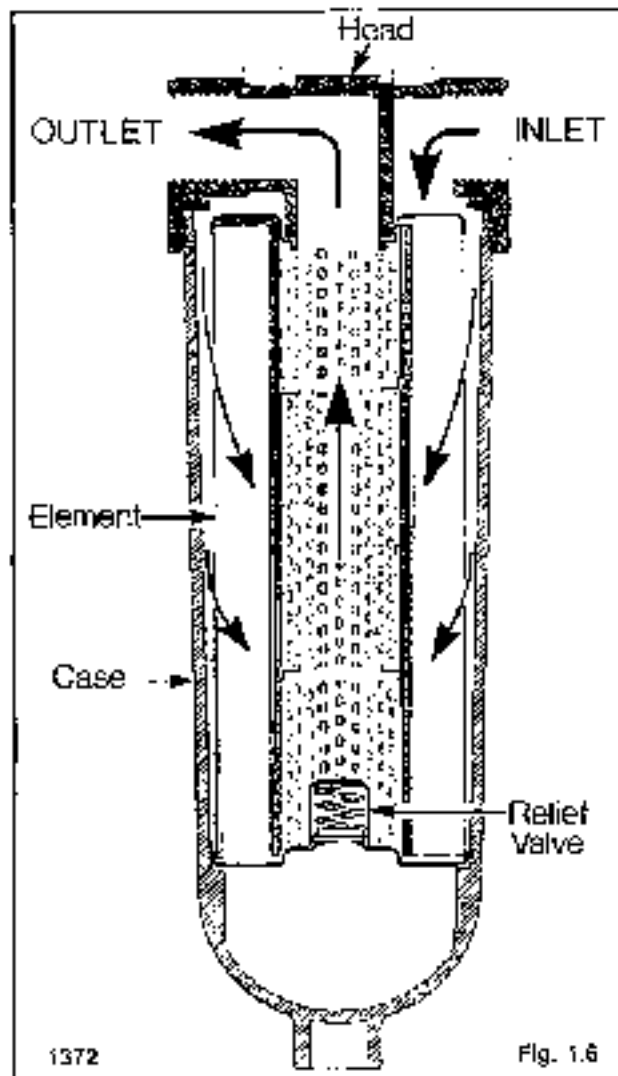
1. Shut off the engine, over the boom arms, ground any attachment and set the parking brake.

SECTION 1 HYDRAULICS

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. Using a 1 1/4 inch wrench, remove the filter case and element (fig. 1.6.f).
3. Lubricate the new cover gasket and O-ring supplied with the new filter with system fluid.
4. Install the filter element in the case making sure the relief valve built into the filter element is at the bottom of the filter case.
5. Screw the filter case onto the head assembly. Torque the filter case to 30 ft. lbs. (41 N.M.). Do not overtorque the filter case. The case material is aluminum and may crack if overtorqued.



1.7 OIL COOLER

1.7.1 Specifications:

Rating BTU per min. 183HD	620
Rating BTU per min. 233HD	920
Max. working pressure	500 PSI (34.5 BAR)
Max. burst pressure	1500 PSI (103.4 BAR)
No. of tubes 183HD	14
No. of tubes 233HD	36
No. of fins per inch	7
Fin gauge	018 (457 mm)
Core area 183HD	140 sq. in. (903 cm ²)
Core area 233HD	348 sq. in. (2245 cm ²)

1.7.2 General Information:

The hydraulic oil cooler (fig. 1.7.2) is mounted on the inside of the rear door. As 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.

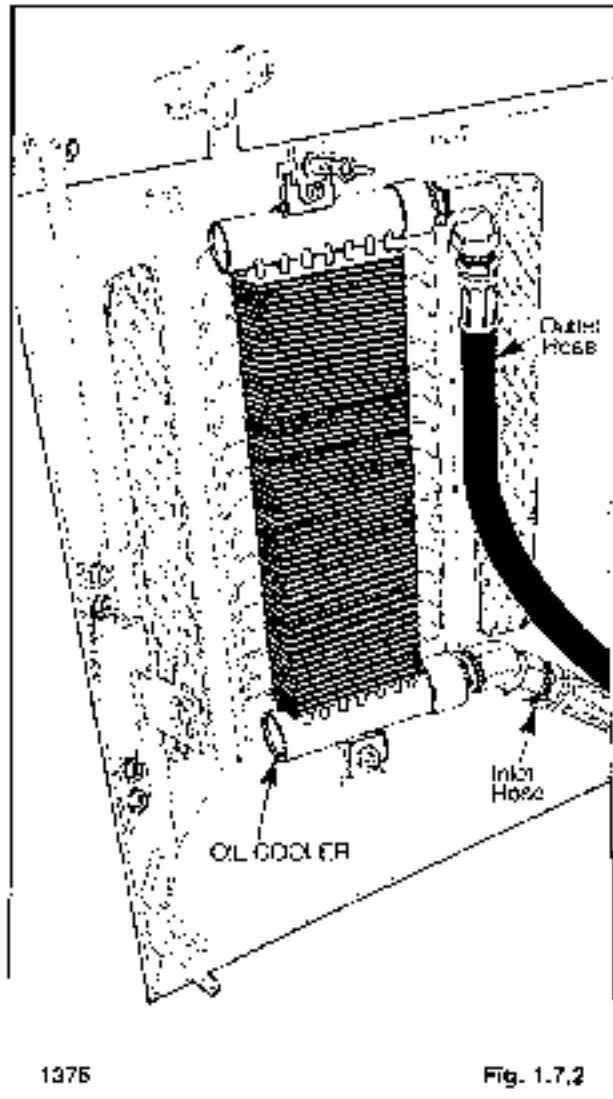
1.7.3 Cooler Service:

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 with compressed air.



WARNING

To avoid eye injury use safety goggles when using air pressure to clean the oil cooler.



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Fig. 1.7.2

1.8 OIL RESERVOIR

1.8.1 Specifications:

Reservoir capacity	18 gal. (68 l)
Oil type	10W30 API, SE, CD
No. of suction filters	2
Suction filter rating	100 micron
Breather cap filter	10 micron
Filter inlet screen	30 mesh
Change oil every	1000 hours
Change suction filters every	1000 hours

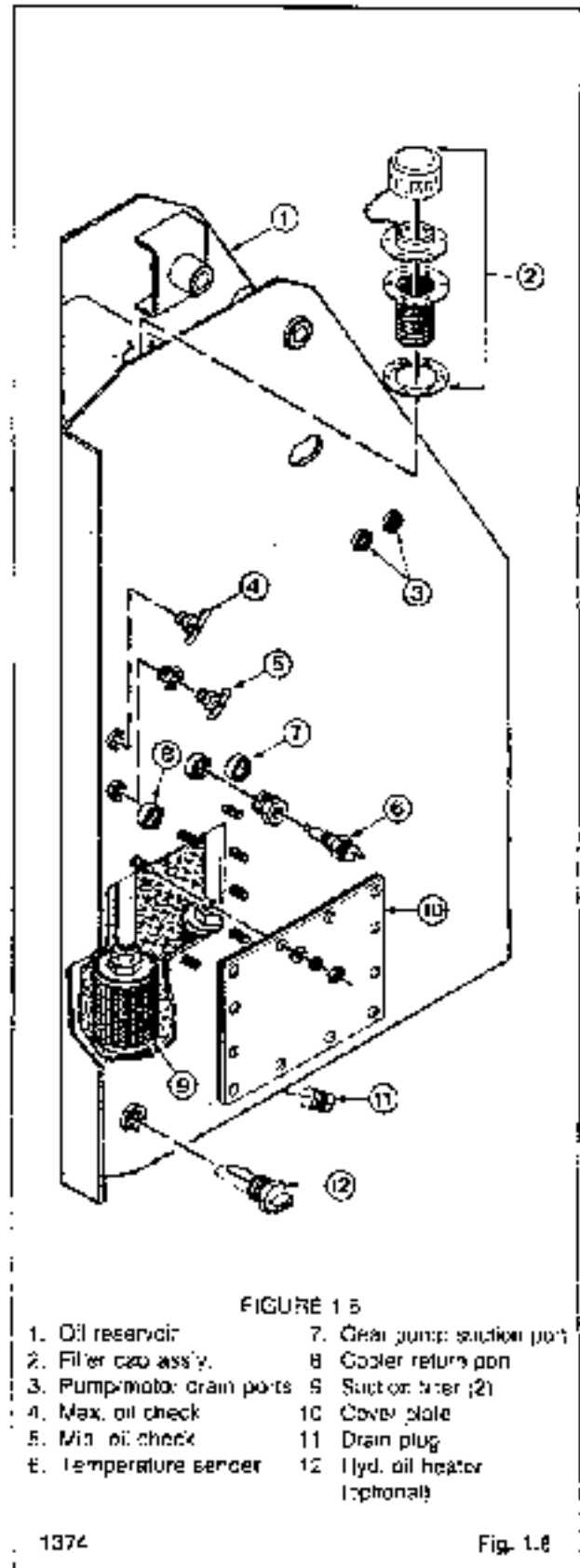


FIGURE 1.5

- | | |
|---------------------------|--------------------------------|
| 1. Oil reservoir | 7. Gear pump suction port |
| 2. Filter cap ass'y. | 8. Cooler return port |
| 3. Pump/motor drain ports | 9. Suction filter (2) |
| 4. Max. oil check | 10. Cover plate |
| 5. Min. oil check | 11. Drain plug |
| 6. Temperature sender | 12. Hyd. oil heater (optional) |

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Fig. 1.6

SECTION 1 HYDRAULICS

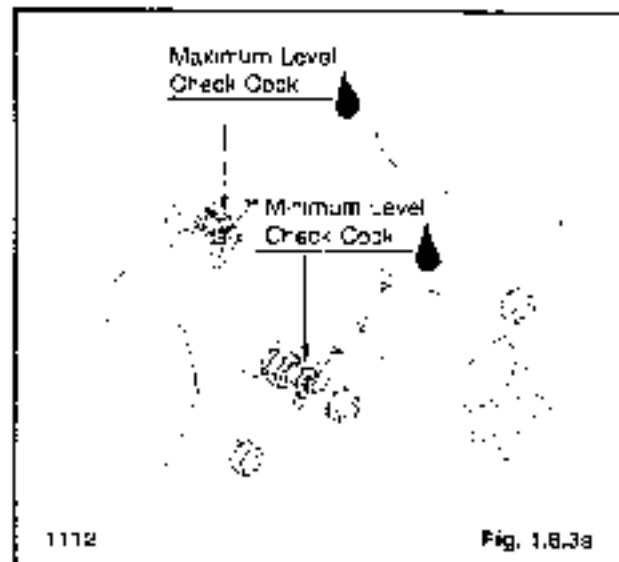
1.8.2 General Information:

The hydraulic oil reservoir is located at the rear of the loader on the left hand side (fig. 1.8). 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 two 100 micron suction filters located inside the hydraulic reservoir (fig. 1.8).

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

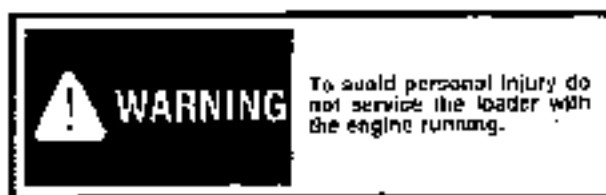


1.8.3 Checking and Adding Oil:

OIL LEVEL CHECK:

The oil level should be checked daily.

1. Check the oil level with the machine on level ground.
2. Shut off the engine, lower the boom arms, ground any attachment and engage the parking brake.



3. Open the rear door.
4. Open the bottom or minimum oil level check cock (fig. 1.8.3a). If oil flows from the check cock the level is satisfactory.
5. Close the check cock.

ADDING OIL

1. Open the top or maximum oil level check plug (fig. 1.8.3a).

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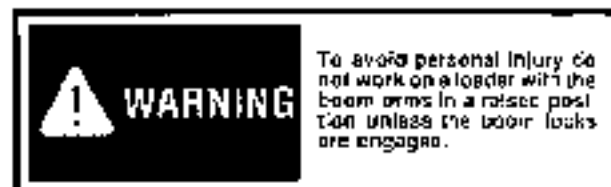
2. Remove the filler cap (fig. 1.8.3b).
3. Inspect the filter screen in the filler neck for damage. If the filter screen is damaged replace it.
4. Using a clean container, add 10W50 API Classification SE, CD until it flows from the maximum level check cock. Total reservoir capacity is 16 gal. (60 l).
5. Close the check cock and 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.

DRAINING THE OIL RESERVOIR:

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

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

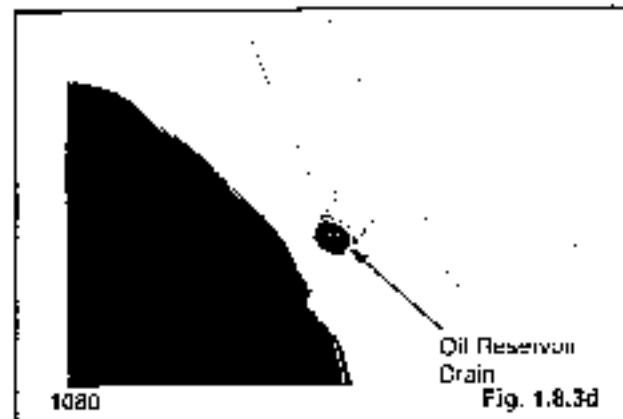
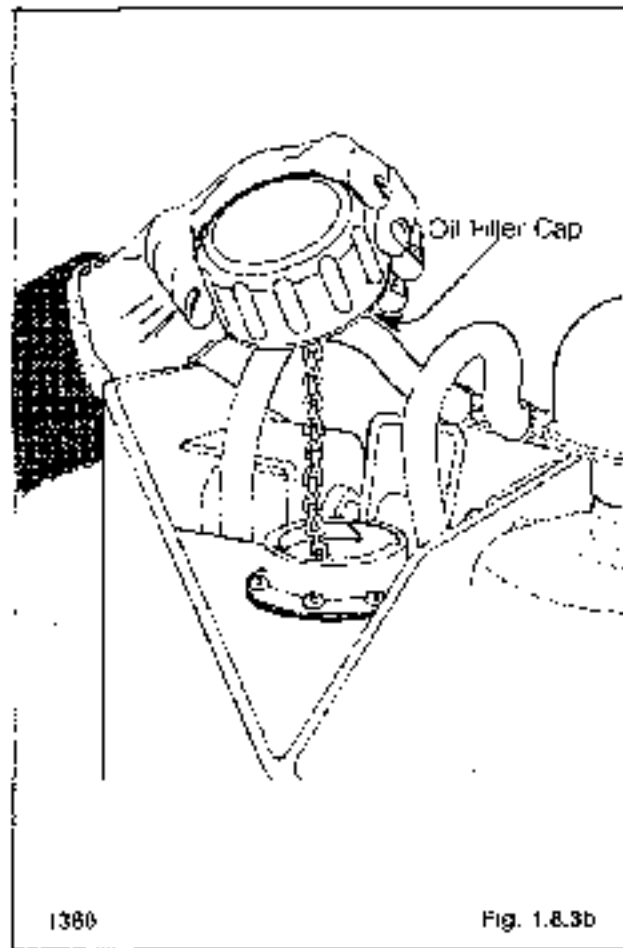


SECTION 1 HYDRAULICS

- To drain: remove the drain plug located at the bottom of the hydraulic oil reservoir (Fig. 1.8.3d).

When refilling use only 10W30 API Classification SAE CD engine oil. Total reservoir capacity 18 gal. (68 l).

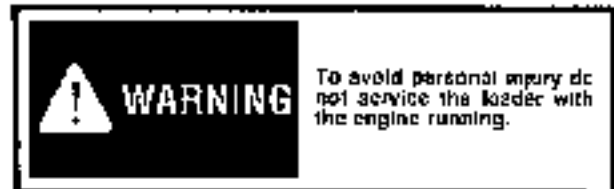
NOTE: If the reservoir is completely drained refer to the start up procedure section 1.2.6 to prevent damage to the hydraulic components.



1.8.4 Filter Replacement:

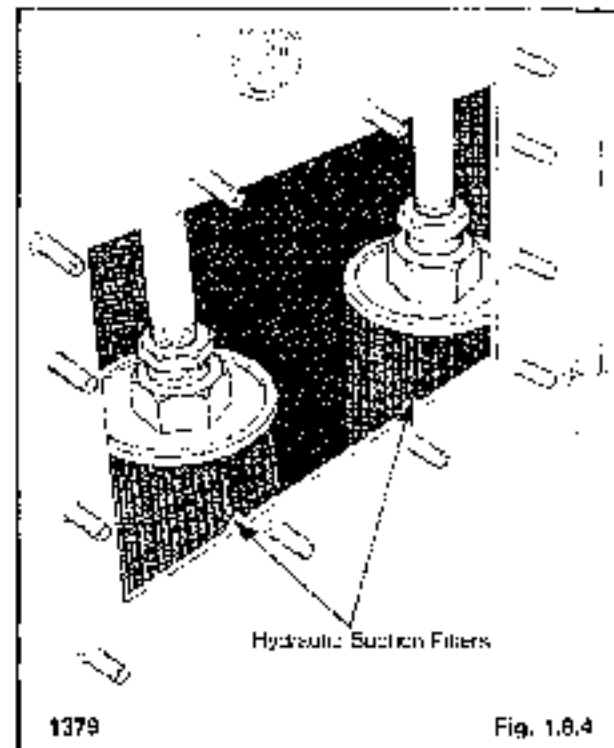
The 100 micron hydraulic suction filters located inside the oil reservoir should be changed every 1000 operating hours or if the oil becomes contaminated or after a major hydraulic drive system repair.

- Drain the oil from the hydraulic oil reservoir (refer to section 1.8.3).
- Open the rear door and clean the area around the oil reservoir inspection cover.



- Remove the inspection cover.
- Remove the two 100 micron suction filters (Fig. 1.8.4).
- Install two new suction filter elements.
- Install the coverplate. Seal with sealer.
- Refill the oil reservoir using 10W30 API Classification SAE CD only. Total reservoir capacity 18 gal. (68 l).

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



SECTION 1 HYDRAULICS

1.9 TROUBLE SHOOTING — HYDRAULIC SYSTEM

Problem	Cause	Corrective Action	Refer to 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.	1.8.3
	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
	Hydraulic charge pump shaft failure	Inspect and replace damaged parts.	2.2.6
	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	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.	1.8.3
	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

Boom raises slowly at full RPM.	Reservoir low on oil	Check for leaks. Fill with 10W30 API SE-CD oil.	1.6.3
	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.	4.4
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.	1.5.3
	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 spools.	1.3.5
	Oil bypassing one or both cylinder piston seals	Check piston seals for leakage and repair.	1.5.3
	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.	1.6.3
	Oil cooler plugged or dirty (also check engine radiator)	Clean the cooling fins.	1.7.1
	Auxiliary foot pedal engaged	Disengage.	

SECTION 1 HYDRAULICS

	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 sensor defective	Replace.	
	Wrong type of fluid used	Replace.	1 5.3

2 HYDROSTATIC DRIVE SYSTEM

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TROUBLE SHOOTING	2.4

2 HYDROSTATIC DRIVE SYSTEM

2.1 HYDROSTATIC DRIVE SYSTEM

2.1.1 Specifications:

	T1834ID	T233HD
Pump type	Hydrostatic, variable displacement, reversible piston	
No. of drive pumps	2	
Mounting	Tandem	
Rotation (viewed from shaft end)	R.H.	
Displacement	2.48 in. ³ /REV (40.64 cm ³)	
Operating speed	2800 RPM	
Relief valve setting	3750 PSI (258.5 BAR)	
No. relief valves per pump	2	
Max. surge pressure	4150 PSI (286 BAR)	
Max. allowable case pressure	25 PS (1.7 BAR)	
Motor type	Geroler Torque Motor	
Displacement	2.48 c.c./r. (40.64 cm ³)	
Reservoir capacity	7.8 c.c. (50 l)	
Fluid type	10W30 API classification SAE CD	
Filtration	10 micron	
Reservoir filtration	Two 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 twin 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.

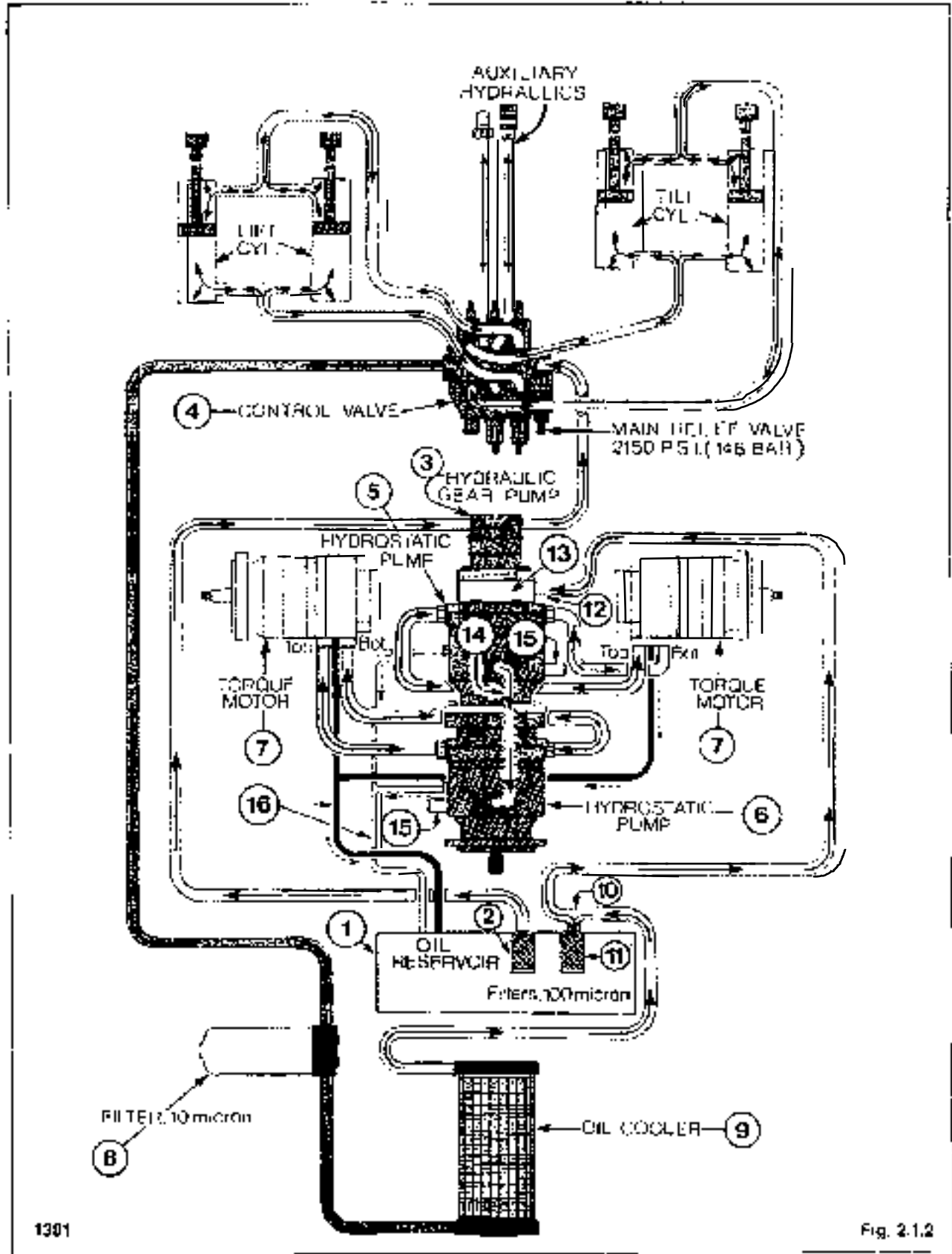
The steering levers, which control both the loader speed and direction are connected through a mechanical linkage to the two hydrostatic pump cam plate shafts (15) which control the flow of oil from both pumps. As the steering levers are moved, oil is pumped from the hydrostatic pumps to the torque motors (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 direct 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 charge pump (13) is located in the end of the front hydrostatic pump (5). The charge pump draws oil from the return side of the hydraulic system after the oil passes through the 10 micron hydraulic filter (8) and the oil cooler (9). The charge pump (13) supplies clean and cooled replenishing oil to the front hydrostatic pump (5) through internal check valves and to the rear hydrostatic pump (6) through a transfer line (14). A relief valve is located at the charge pump inlet port (12) to recirculate oil not required to replenish the closed loop circuits.

2 HYDROSTATIC DRIVE SYSTEM



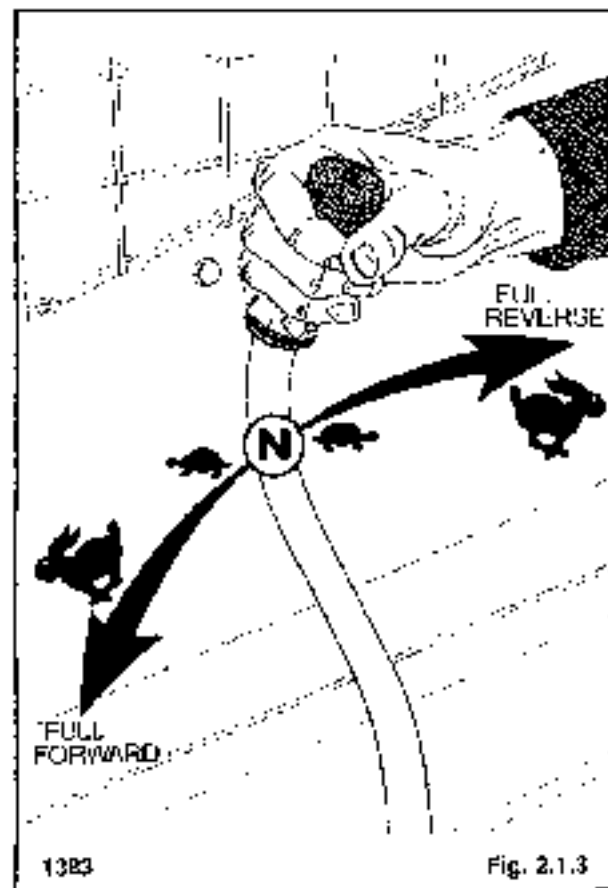
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Fig. 2.1.2

2 HYDROSTATIC DRIVE SYSTEM

2.1.3 Control Functions:

Two steering levers control speed direction and turning 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 centre or neutral position (fig. 2.1.3). 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.



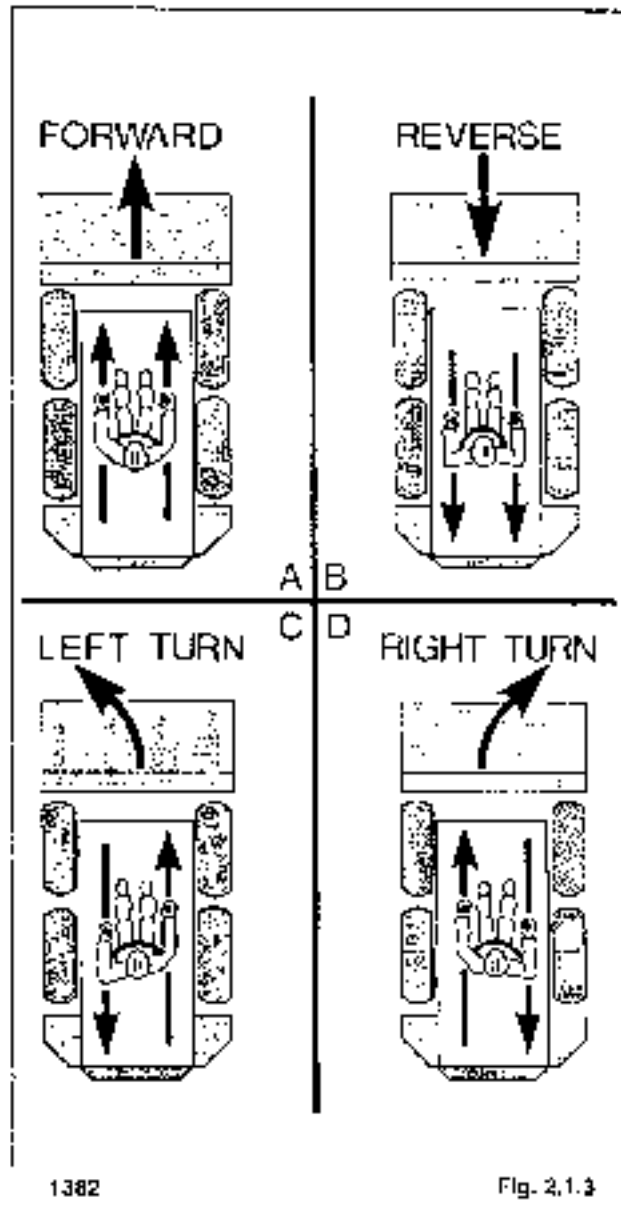
To drive the loader forward in a straight line, move both control levers forward the same amount (fig. 2.1.3a).

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.

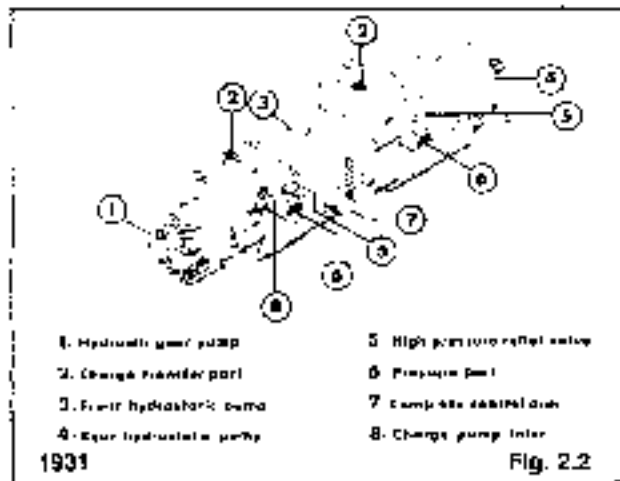
For the loader to turn or "skid-steer" with its own length, one lever is moved forward and the other back. This causes the wheels on one side to turn forward and the wheels on the other side to "reverse turning" the loader (fig. 2.1.3 c & d).

NOTE: The steering control levers automatically center in neutral position when the seal bar is in the up position.



2 HYDROSTATIC DRIVE SYSTEM

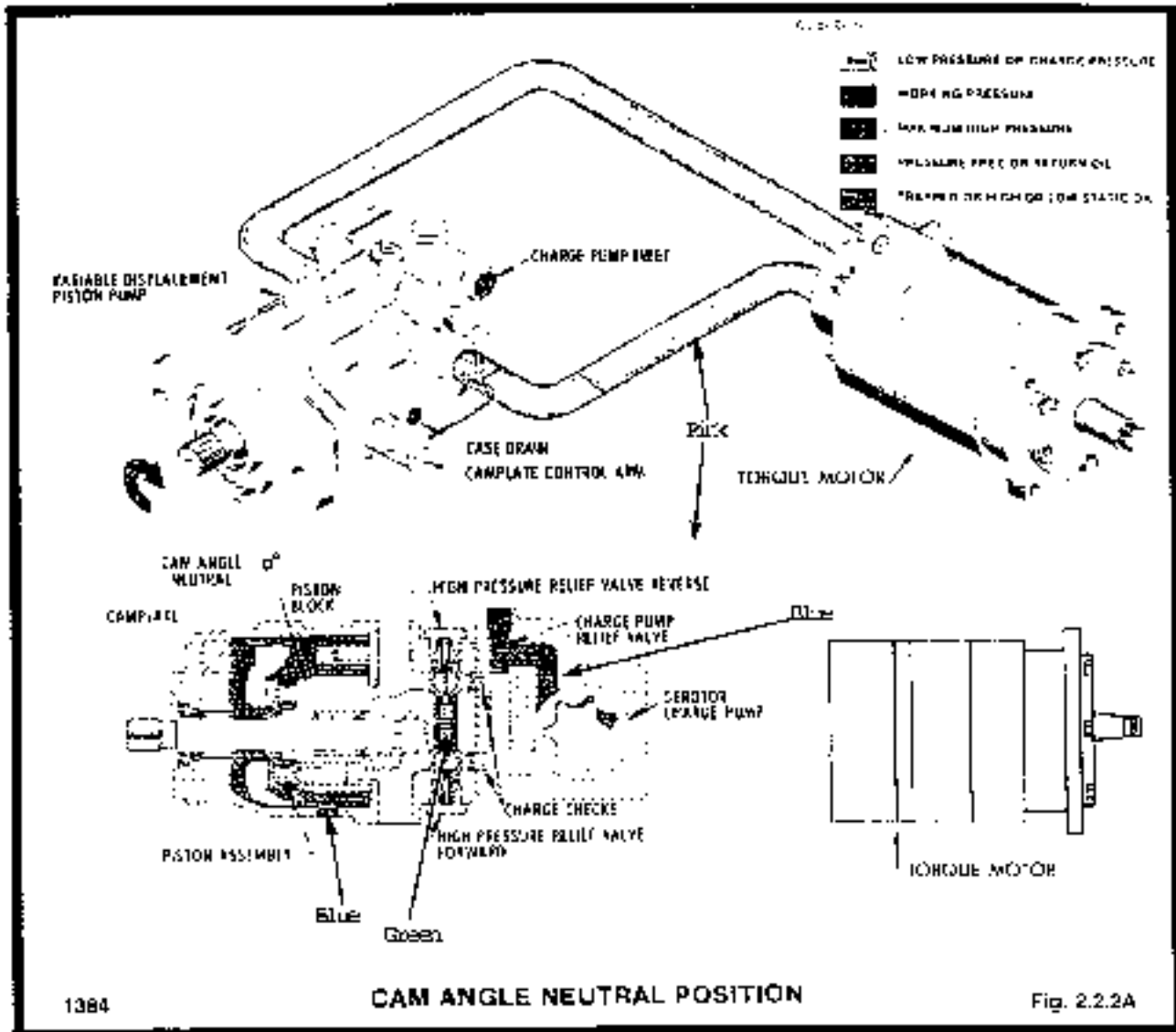
2.2 HYDROSTATIC PUMPS



2.2.1 Specifications:

	T103HD	T233HD
Pump type.....		Hydrostatic, variable displacement, piston
No. of drive pumps.....		2
Mounting.....		Tandem
Rotation (viewed from shaft end).....		Right Hand
Displacement.....	2.48 cu. in./REV (40.64 cm ³)	
Operating speed (RPM) ...	2950	2800
Relief valve setting.....	3750 PSI (258.5 BAR)	
No. relief valves per pump		2
Max. surge pressure	4150 PSI (286 BAR)	
Max. allowable case pressure	25 PSI (1.7 BAR)	

2.2.2 General Information:



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2 HYDROSTATIC DRIVE SYSTEM

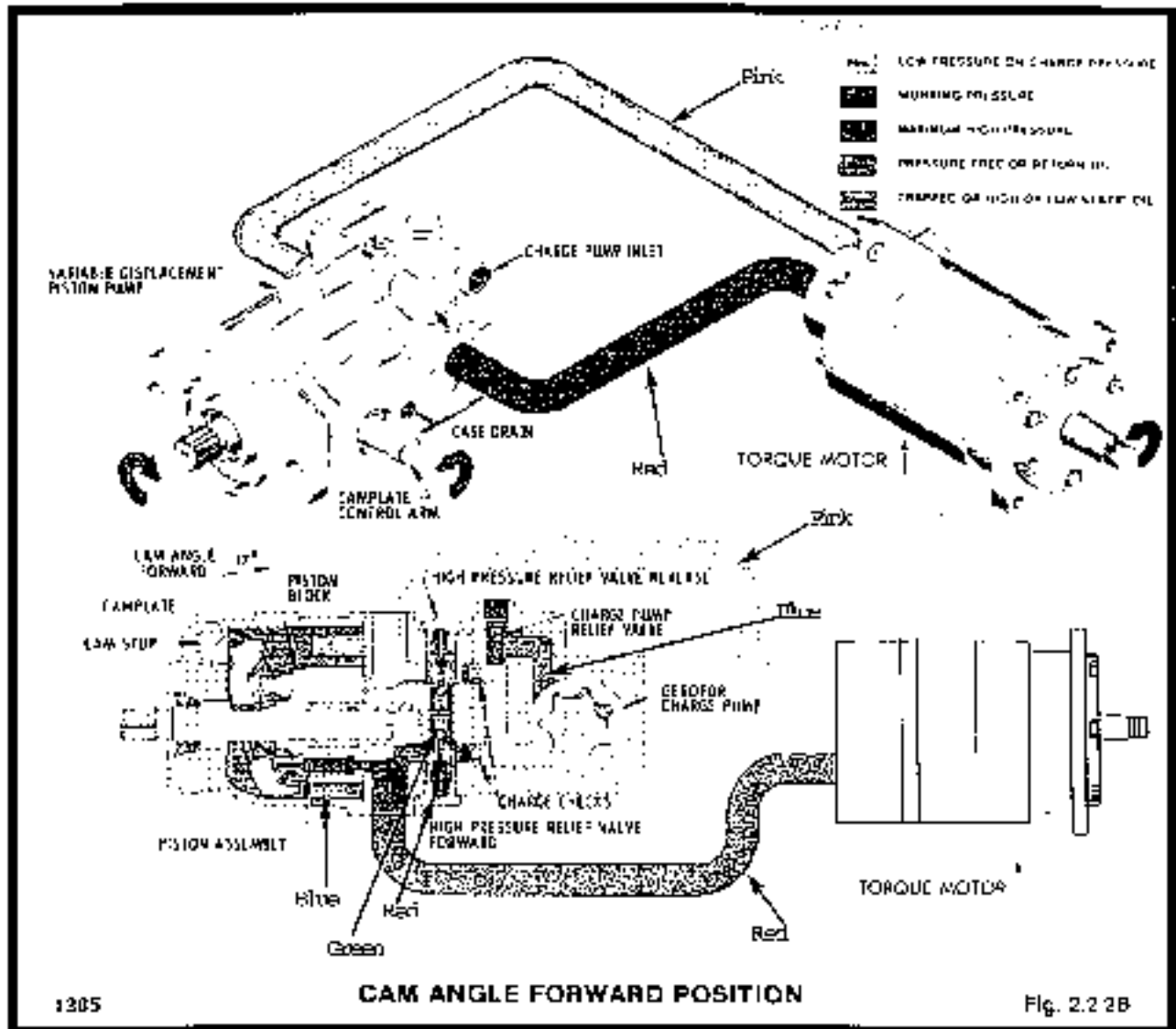
The drive shaft of the piston pump is rotated by the engine. The piston block which is splined to the drive shaft also turns. The piston block contains nine piston assemblies which have free swiveling shoes swagged on the ball end of the piston assembly. The shoe end of the piston rides against the smooth 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.

The purpose of the gerotor charge pump is to keep the closed loop full by replenishing the oil that is lost through internal leakage. The gerotor charge pump keeps the intake or low pressure side of the system supplied with oil.

With the camplate in the 0° or neutral position the pressure of the charge oil, which ranges from 60 to 150 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 over the charge pump relief valve and is recirculated back into the intake side of the gerotor charge pump. The oil that leaks internally in the pump and motor collects in their sump 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.



2 HYDROSTATIC DRIVE SYSTEM

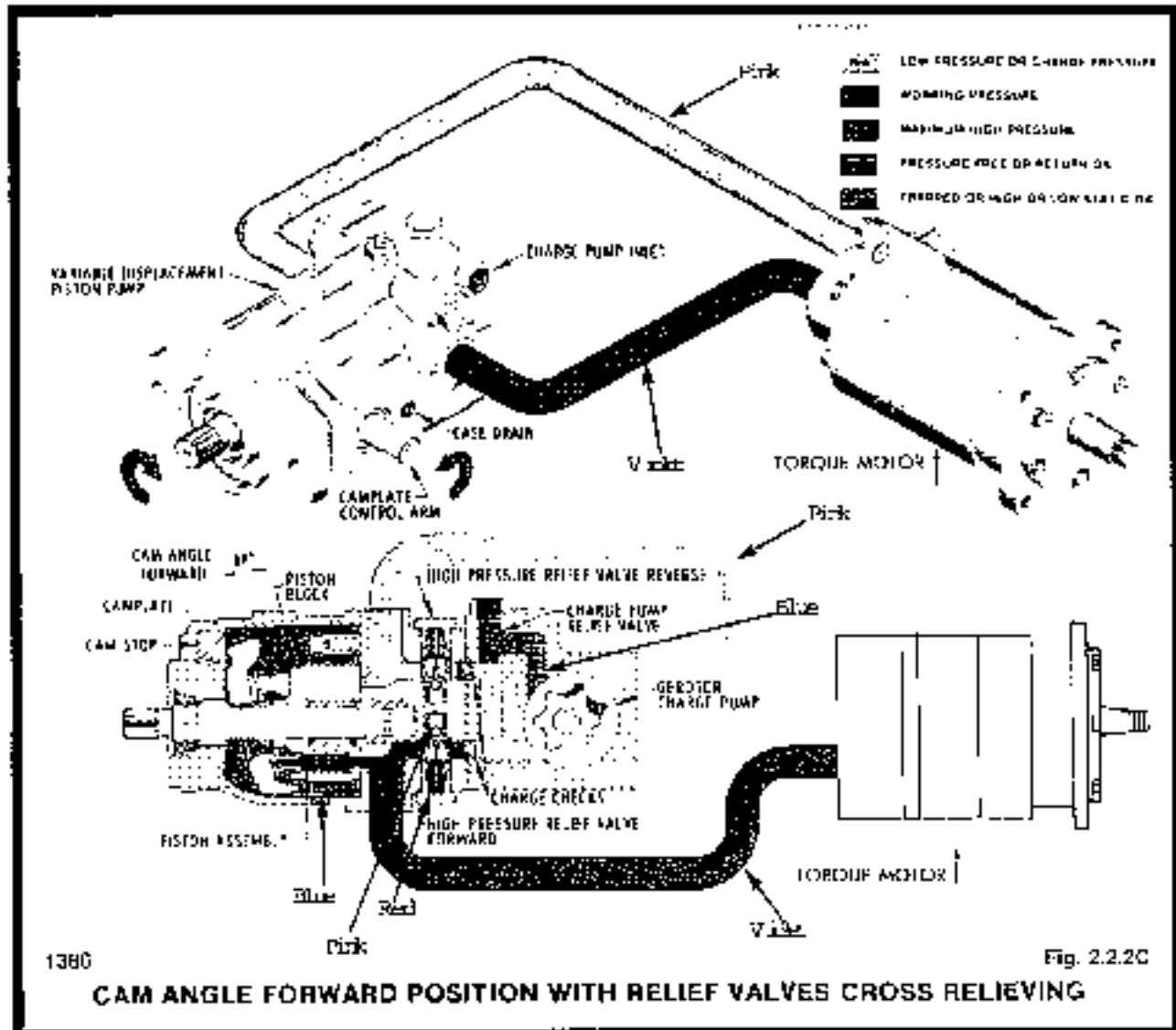
When the camplate begins to move the charge check on the discharge or pressure side seats because of the higher pressure differential. The other charge check remains open on the intake or low pressure side to continue supplying the closed loop system with a charge of oil.

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.

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 sealed 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.



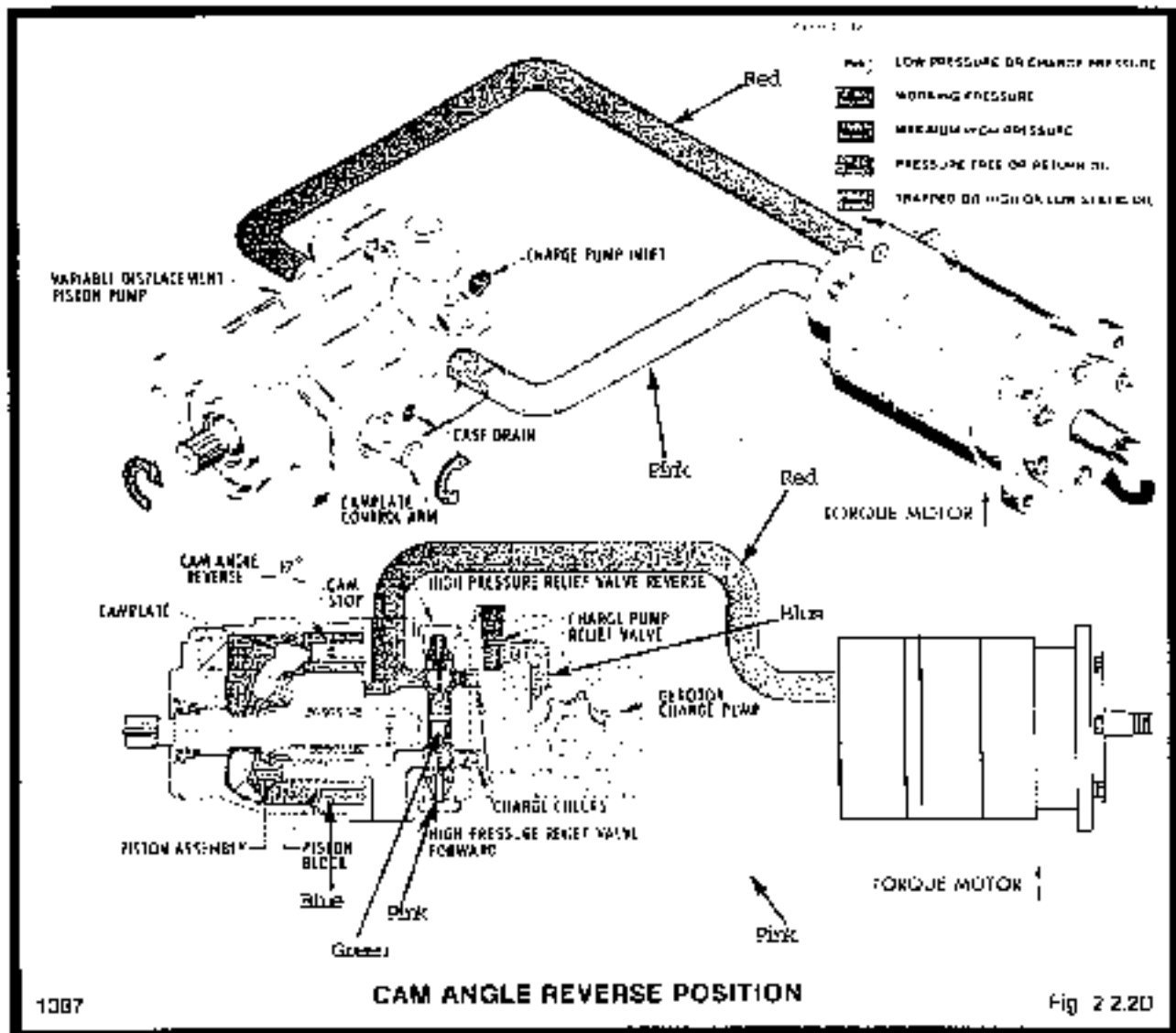
2 HYDROSTATIC DRIVE SYSTEM

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

The steering lever can be moved in reverse until a full cam angle of 17° has been reached, which also achieves

maximum volume of oil being discharged from the pump. When the camplate begins to move the charge check on the discharge or pressure side seals 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.

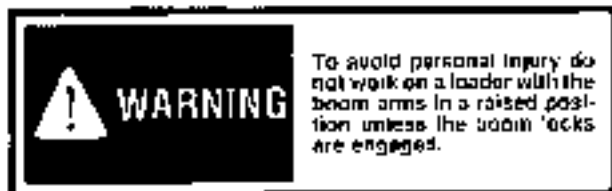
In the reverse position the pump shaft still rotates in the same direction, but the discharge of oil from the pump is reversed. Thus reversing the rotation of the motor.



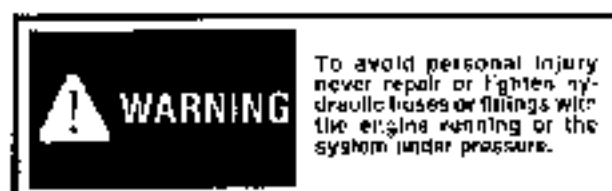
2 HYDROSTATIC DRIVE SYSTEM

2.2.3 Hydrostatic Pump, Removal:

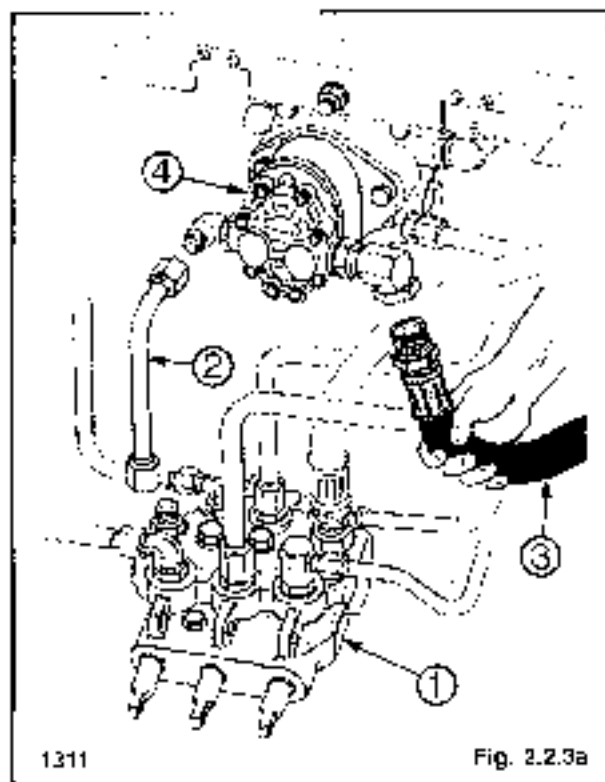
1. Remove any attachment, raise the boom arms and engage the boom lock stop of the engine.



2. Draw the hydraulic oil from the oil reservoir. Refer to section 1 B 3 for procedure.



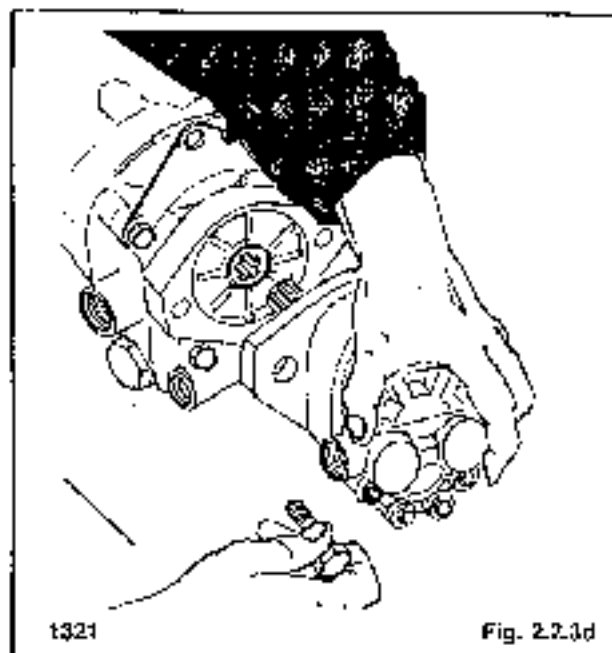
3. Remove the seal and the front shield.
4. Disconnect the line between the hydraulic oil reservoir and the hydraulic gear pump at the gear pump inlet port (fig. 2.2.3a). Cap the hose and pump port.



5. Disconnect the line between the hydraulic gear pump and the control valve (fig. 2.2.3a).

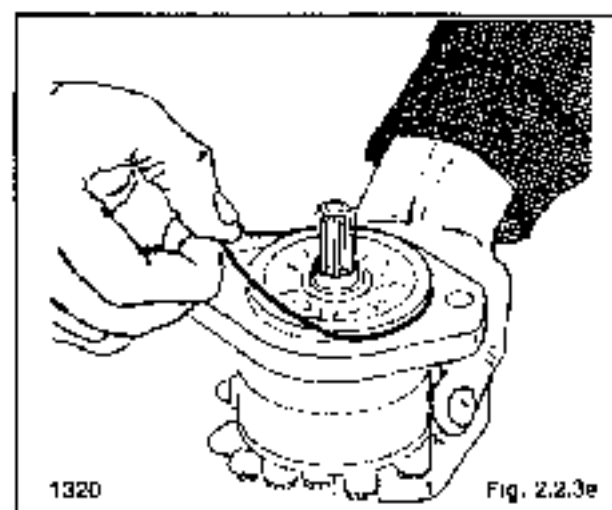
6. Remove the two bolts which hold the hydraulic gear pump to the hydrostatic pump (fig. 2.2.3c).

On reassembly torque the two mounting bolts 27-31 ft lbs. (37-42 N.M.).



7. Remove the hydraulic gear pump from the hydrostatic pump.
8. Remove the O-ring from the mounting flange of the hydraulic gear pump (fig. 2.2.3e).

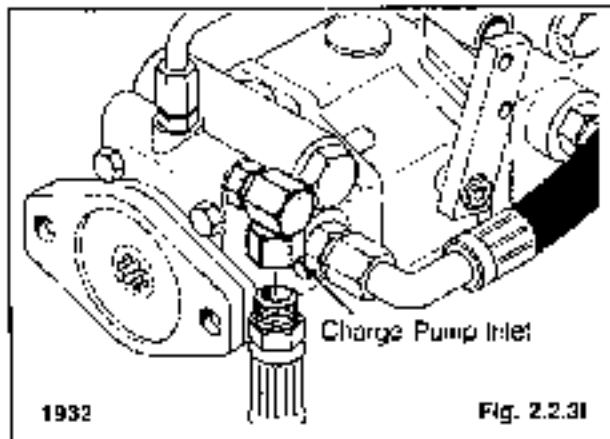
On reassembly install a new O-ring.



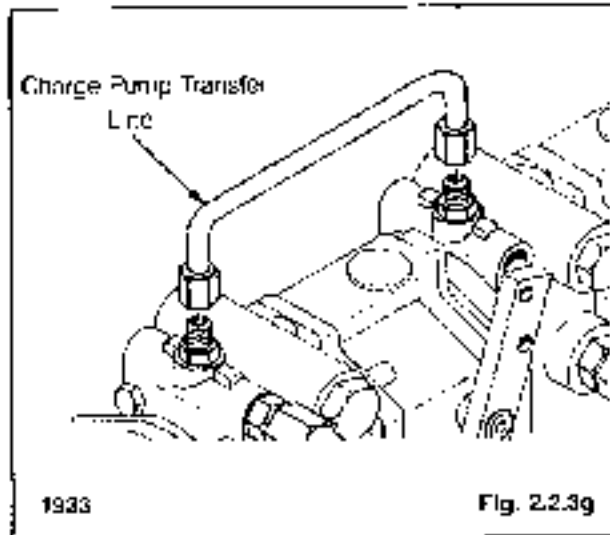
9. Remove the hydraulic hose from the charge pump inlet port (fig. 2.2.3f).

Plug the inlet port and cap the hydraulic line.

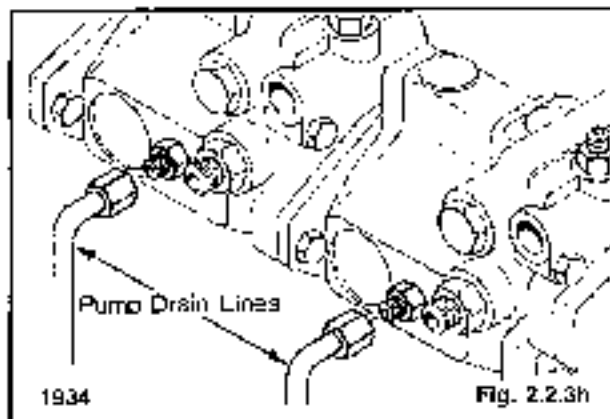
2 HYDROSTATIC DRIVE SYSTEM



10. Disconnect and remove the charge pump transfer line between the front and rear pump (Fig. 2.2.3g). Cap the line and plug both transfer ports.



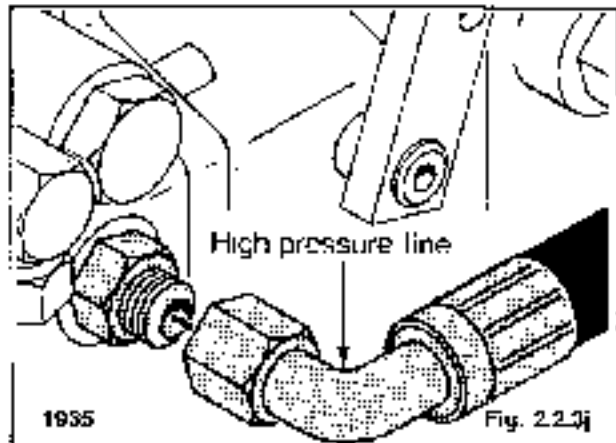
11. Disconnect the drain line from the front hydrostatic pump (Fig. 2.2.3h). Cap the drain line and plug the pump port.



12. Disconnect the high pressure lines between the pump and motor at the pump (Fig. 2.2.3j).

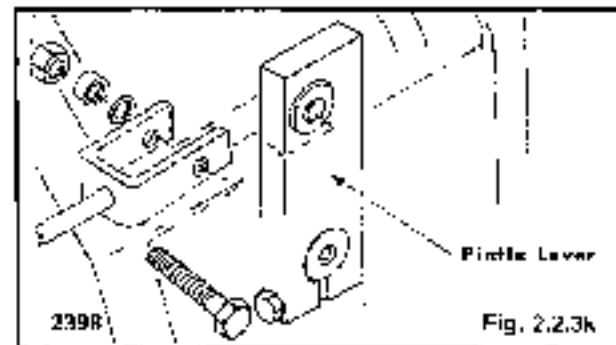
If the rear pump is to be removed disconnect the rear pump's high pressure lines.

Plug the pump ports and cap the hydraulic lines.



13. Disconnect the steering control linkage from the pump's pilot lever (Fig. 2.2.3k).

If the rear pump is to be removed disconnect the steering linkage from the rear pump.



14. Remove the ball from the front pump mounting bracket (Fig. 2.2.3l).

15. Remove the mounting balls which secure the front pump to the rear pump (Fig. 2.2.3m).

On reassembly torque the mounting balls 55-60 ft. lbs. (75-81 N.M.).

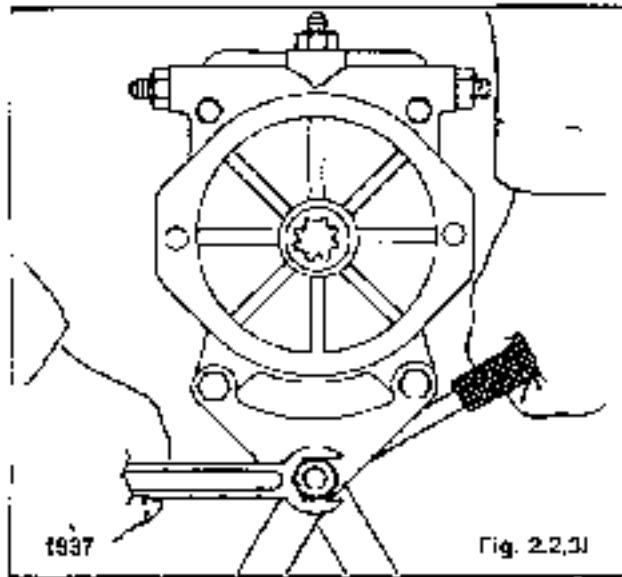
16. Remove the front pump from the loader.

17. Remove the mounting bolts which secure the rear pump to the frame.

18. Remove the rear pump from the loader.

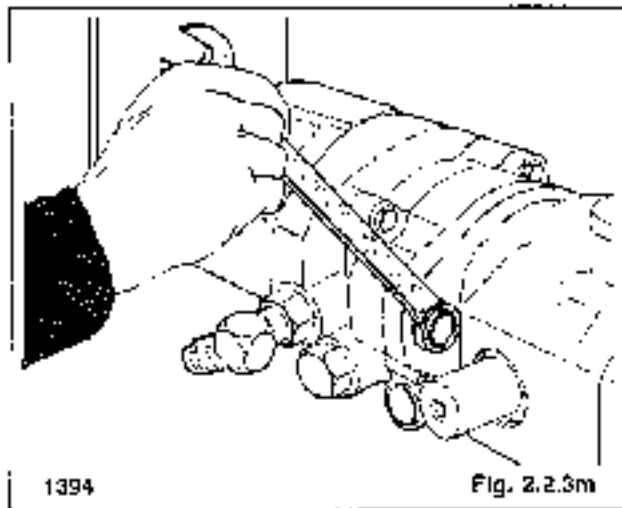
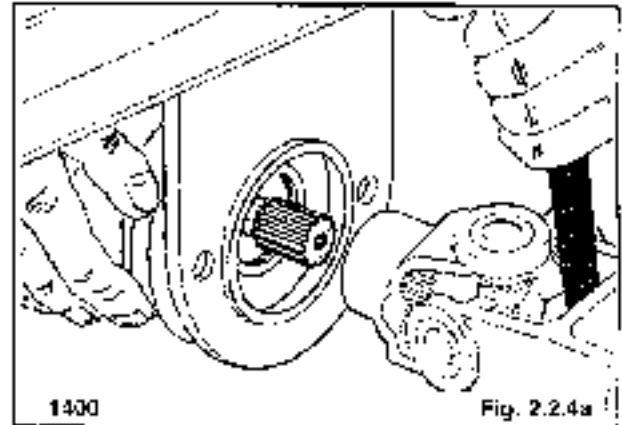
19. Remove the splined drive coupling from the rear pump (Fig. 2.2.3n).

2 HYDROSTATIC DRIVE SYSTEM

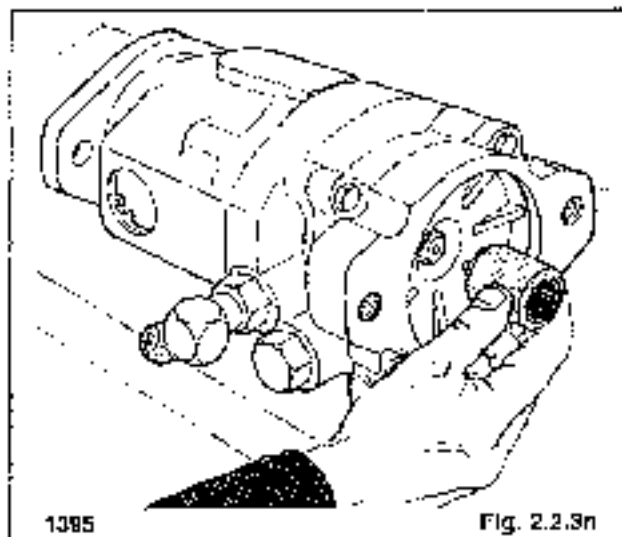
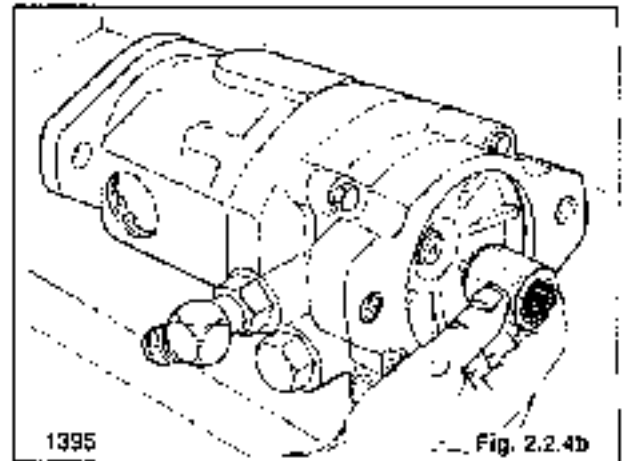


2.2.4 Hydrostatic Pump, Replacement:

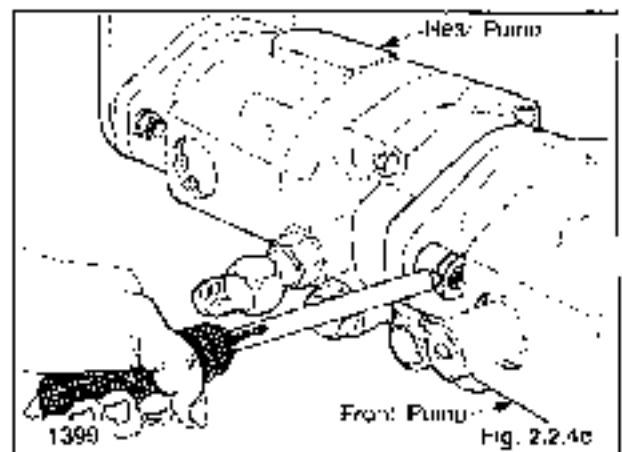
1. Line up the universal joint with the splines on the rear pump shaft and install the rear pump in the loader (fig. 2.2.4a). Install the rear pump mounting bolts.



2. Install the spline coupling on the rear pump (fig. 2.2.4b).

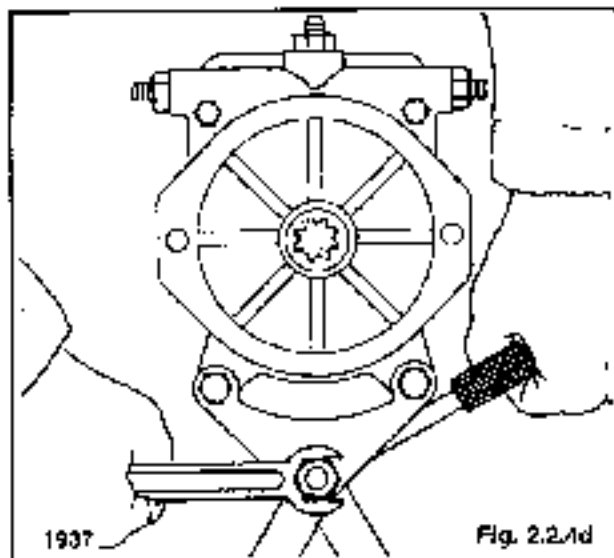


3. Install the front pump in the loader. Torque the mounting bolts 55-60 ft. lbs. (75-81 N.M.) (fig. 2.2.4c).

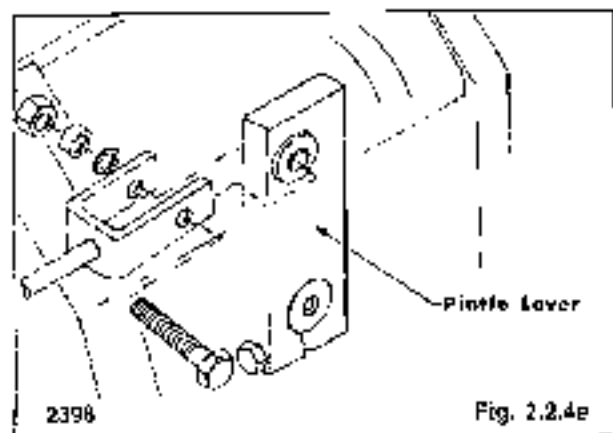


2 HYDROSTATIC DRIVE SYSTEM

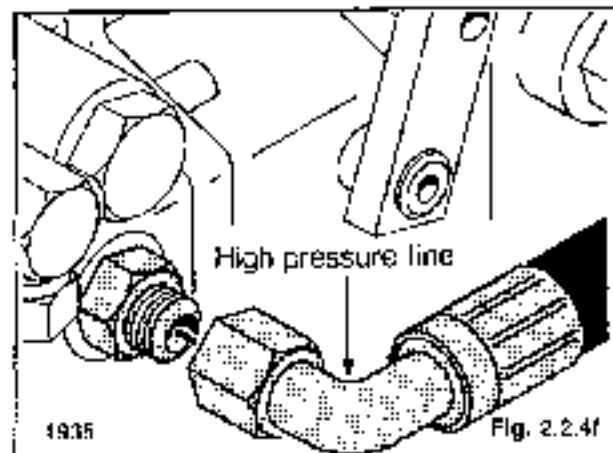
4. Install the front pump mounting bracket (fig. 2.2.4d)



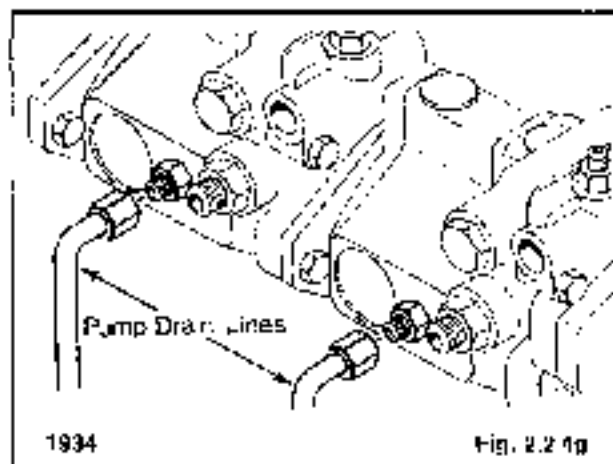
5. Reconnect the steering control linkages to the front and rear pumps (fig. 2.2.4e)



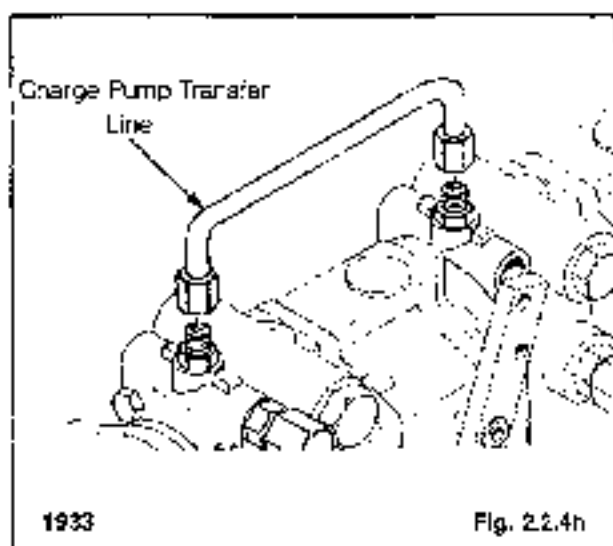
6. Install the high pressure lines between the pumps and motors (fig. 2.2.4f)



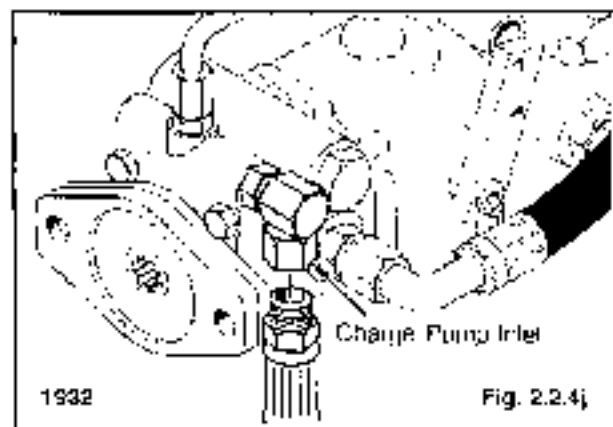
7. Install the pump drain lines (fig. 2.2.4g)



8. Install the charge pump transfer line between the front and rear pump (fig. 2.2.4h)



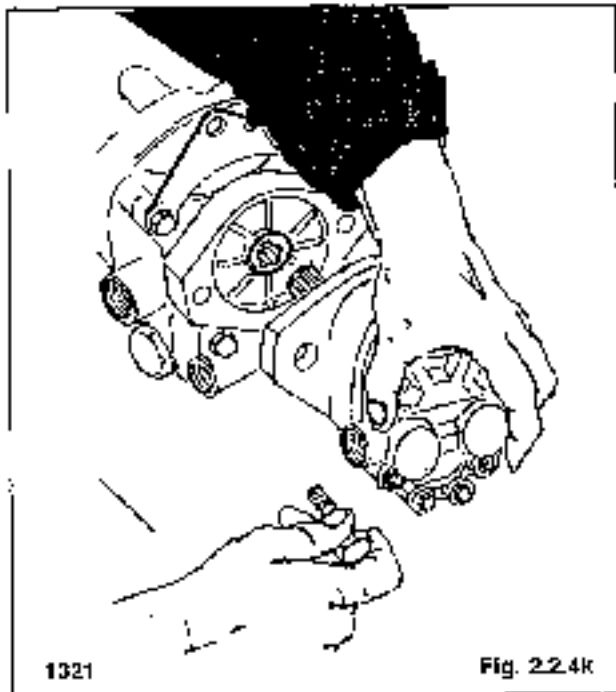
9. Install the hose from the oil reservoir to the charge pump inlet port on the pump (fig. 2.2.4j)



2 HYDROSTATIC DRIVE SYSTEM

10. Install the hydraulic gear pump (fig. 2.2.4k).

Torque the gear pump mounting bolts 27-31 ft. lbs. (37-42 N.M.).

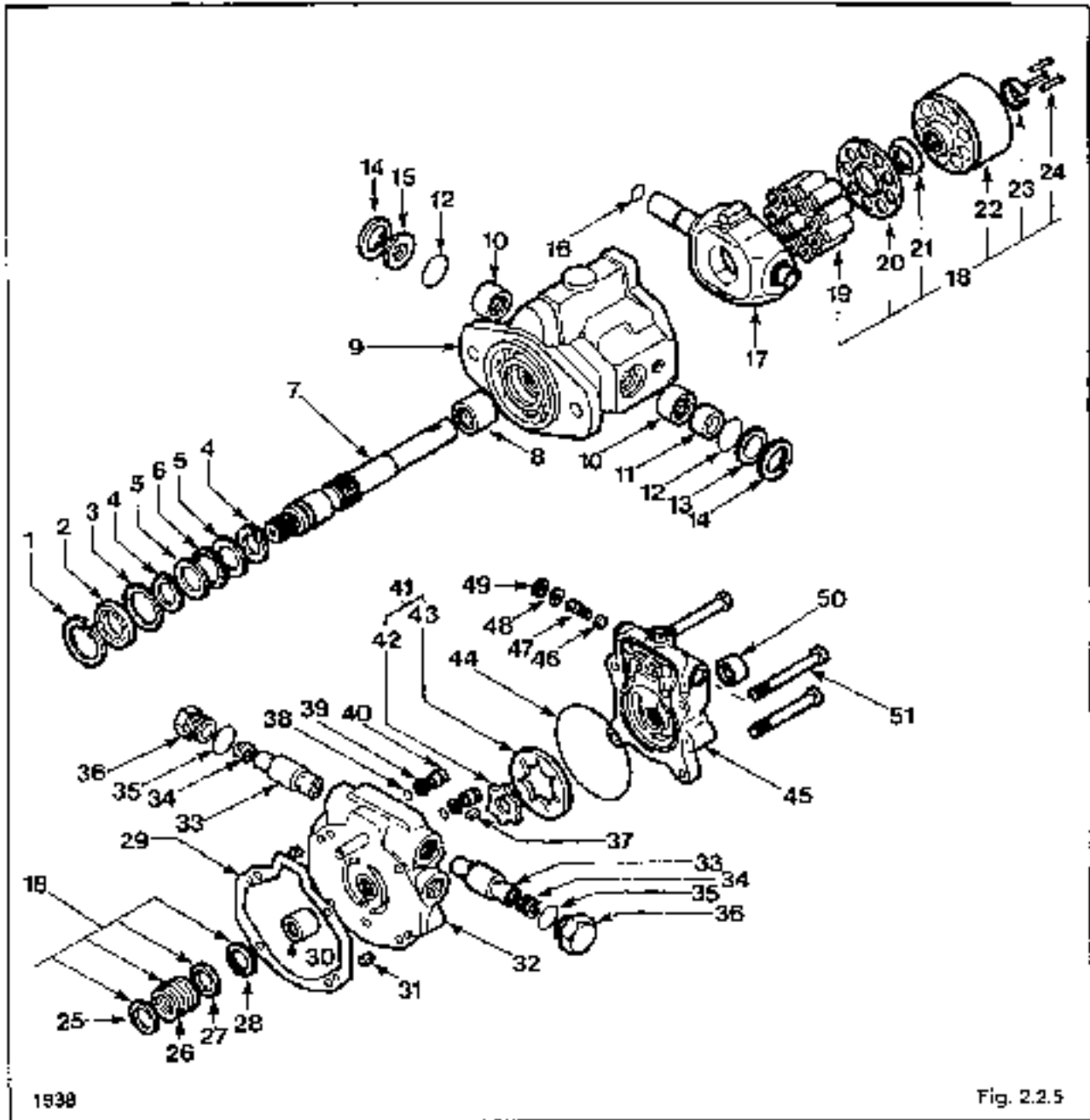


Reconnect the gear pump inlet hose and install the hose between the gear pump outlet and control valve.

11. Refill the hydraulic reservoir to the proper level with 10WQC API classification SL-CD oil.
12. 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 HYDROSTATIC DRIVE SYSTEM

2.2.5 Hydrostatic Pump. Disassembly:



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Fig. 2.2.5

- | | | | | |
|--------------------|--------------------|--------------------|---------------------|--------------------|
| 1. Retaining ring | 12. O-ring | 23. Pin keeper | 34. Spring | 45. Adaptor plate |
| 2. Shaft seal | 13. Camplate cover | 24. Pin (3) | 25. O-ring | 46. Pin |
| 3. Washer | 14. Retaining ring | 25. Washer | 36. Plug | 47. Spring |
| 4. Retaining ring | 15. Camplate cover | 26. Spring | 37. Key | 48. Washer |
| 5. Thrust race | 16. O-ring | 27. Washer | 38. Back-up washer | 49. Retaining ring |
| 5. Thrust bearing | 17. Camplate | 20. Retaining ring | 39. O-ring | 50. Bearing |
| 7. Drive shaft | 18. Rotating group | 29. Gasket | 40. Check valve | 51. Cap screw |
| 8. Bearing | 19. Piston (B) | 30. O-ring | 41. Charge pump kit | |
| 9. Housing | 20. Spider | 31. Dowel pin (?) | 42. Inner gerotor | |
| 10. Needle bearing | 21. Spider pivot | 32. Back plate | 43. Outer gerotor | |
| 11. Inner race | 22. Piston block | 33. Relief valve | 44. O-ring | |

2 HYDROSTATIC DRIVE SYSTEM

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.



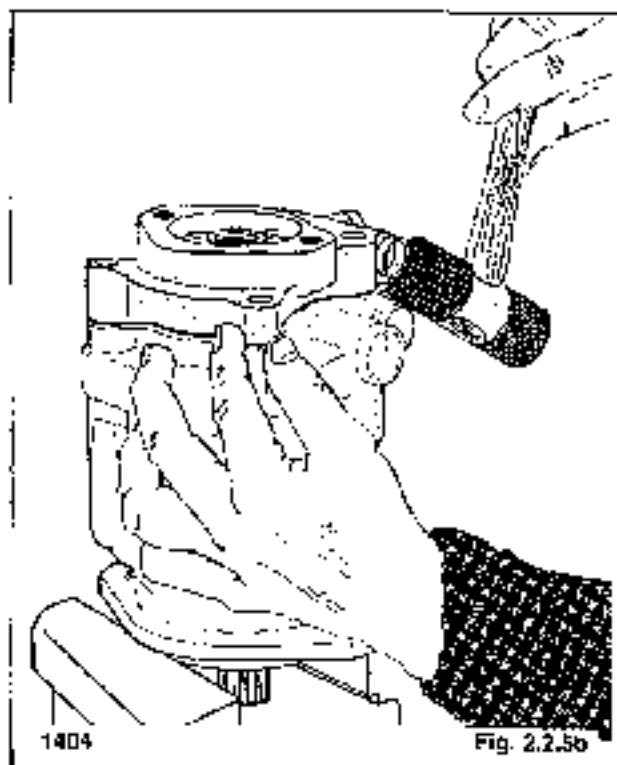
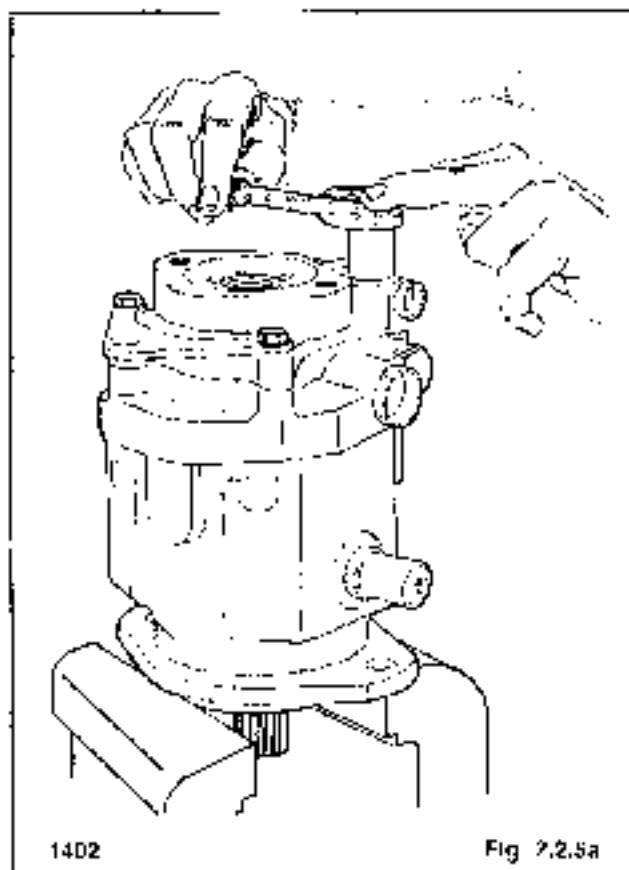
WARNING

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.

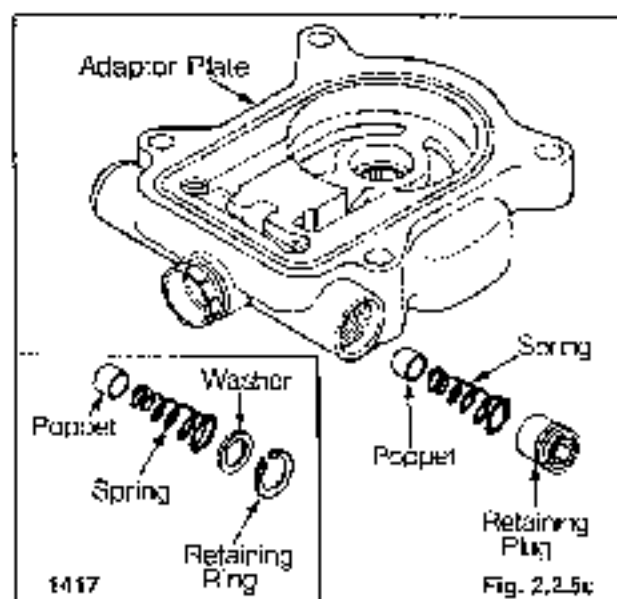
1. Remove the four cap screws and the pump support bracket from the pump assembly (fig. 2.2.5a).
2. Use a plastic hammer and tap the adaptor plate to loosen it from the back plate. Remove the adaptor plate from the pump assembly (fig. 2.2.5b).



IMPORTANT

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

2. Remove the retaining ring, washer, spring and poppet from the adaptor plate assembly (fig. 2.2.5c).

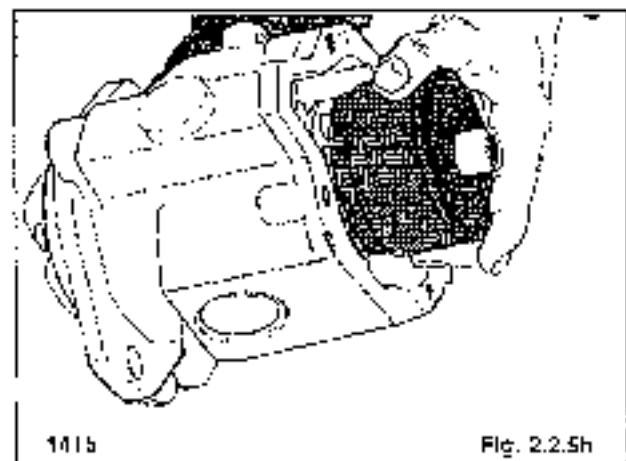
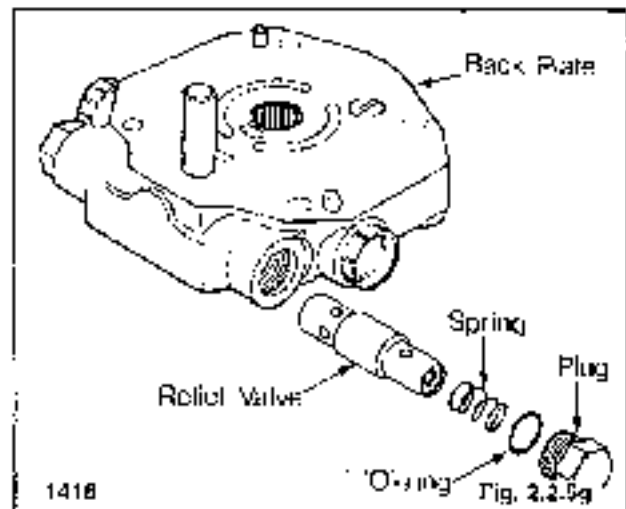
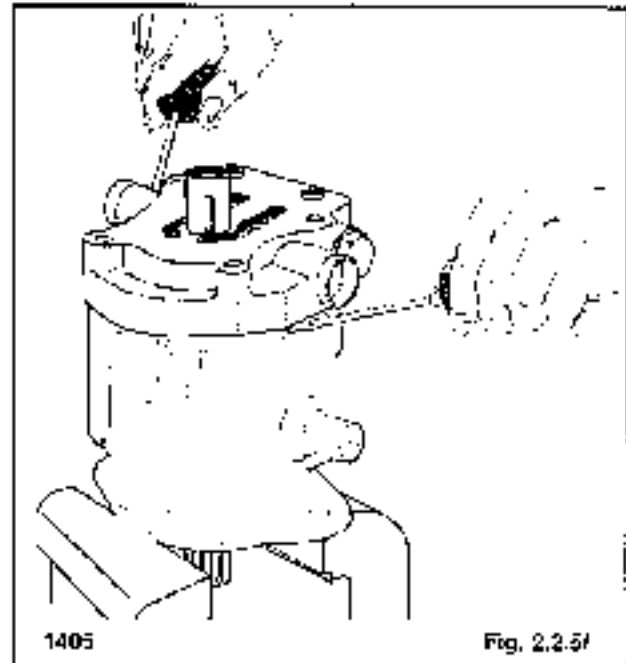
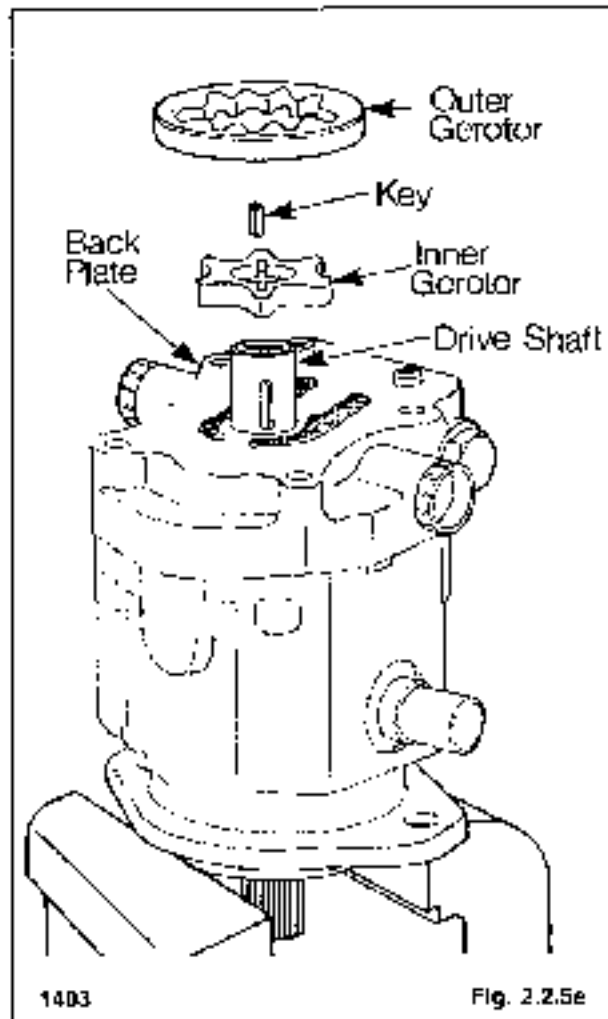


2 HYDROSTATIC DRIVE SYSTEM

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

IMPORTANT

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



5. Using the two screw driver slots cast in the pump housing, separate the back plate from the housing (fig. 2.2.5f).
6. Remove and discard the gasket between the housing and back plate assembly.
7. Remove the two high pressure relief valves from the back plate assembly (fig. 2.2.5g).
8. Remove the rotating group from the housing (fig. 2.2.5h).
9. The piston block assembly does not require disassembly unless the pins or springs are clogged.

2 HYDROSTATIC DRIVE SYSTEM

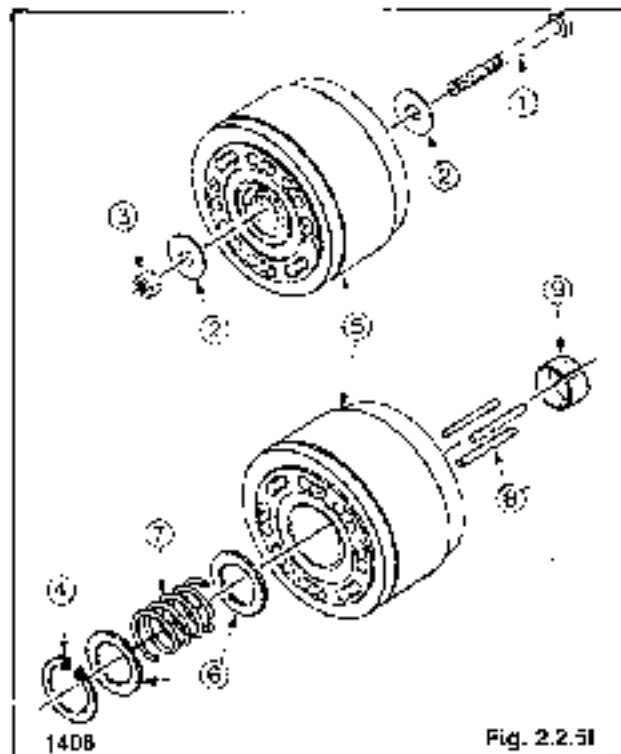


WARNING

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

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

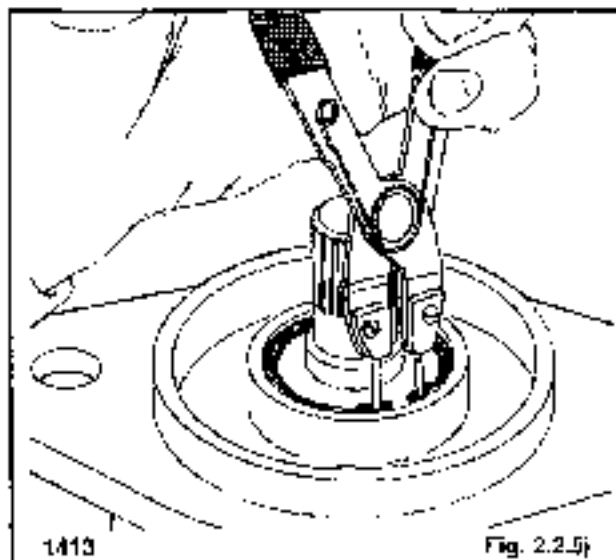
- (a) Place a 5/16 flat washer over the 5/16 x 2 7/0 cap screw and insert the cap screw through the center of the piston block.
- (b) Place a 5/16 flat washer over the end of the cap screw and screw on the 5/16 UNC nut.
- (c) Tighten the nut and compress the spring.
- (d) Remove the retaining ring.
- (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.



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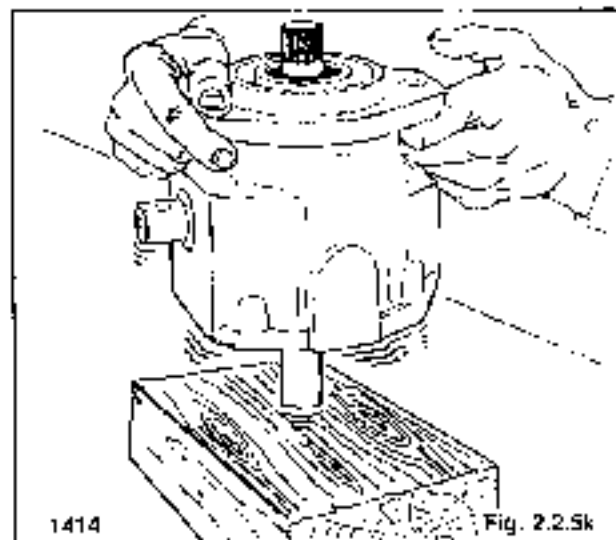
Fig. 2.2.5j

10. Remove the retaining ring from the housing (fig. 2.2.5i).
11. 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).
12. Remove the seal, spacer, retaining ring, thrust bearing and races from the pump shaft (fig. 2.2.5l).



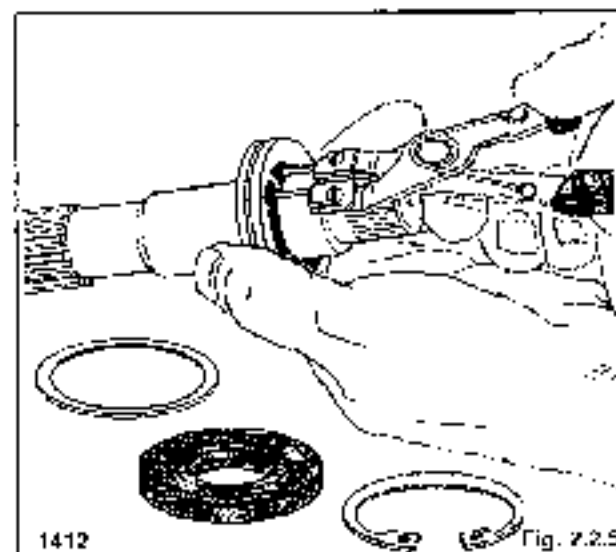
1413

Fig. 2.2.5j



1414

Fig. 2.2.5k

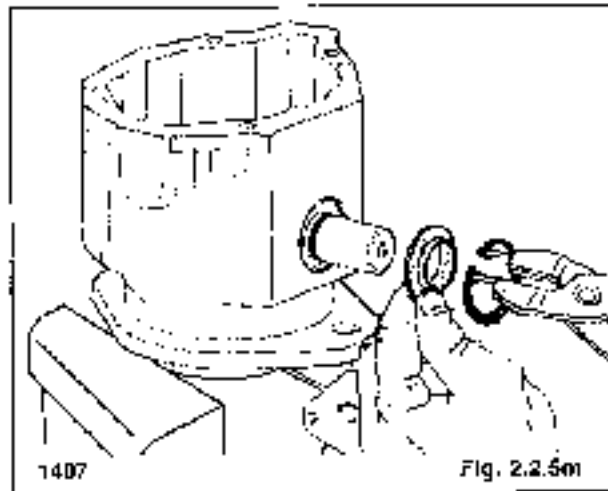


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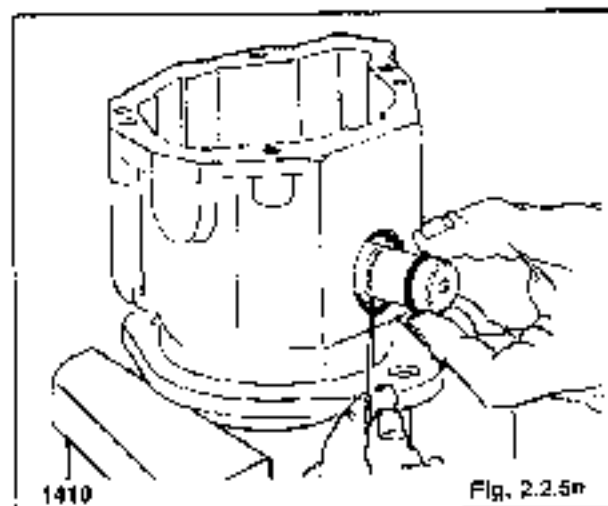
Fig. 2.2.5l

2 HYDROSTATIC DRIVE SYSTEM

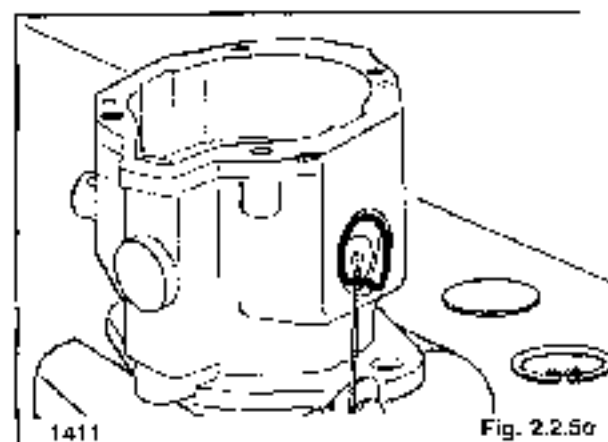
13. Remove the retaining ring and the camplate cover (fig. 2.2.5m).



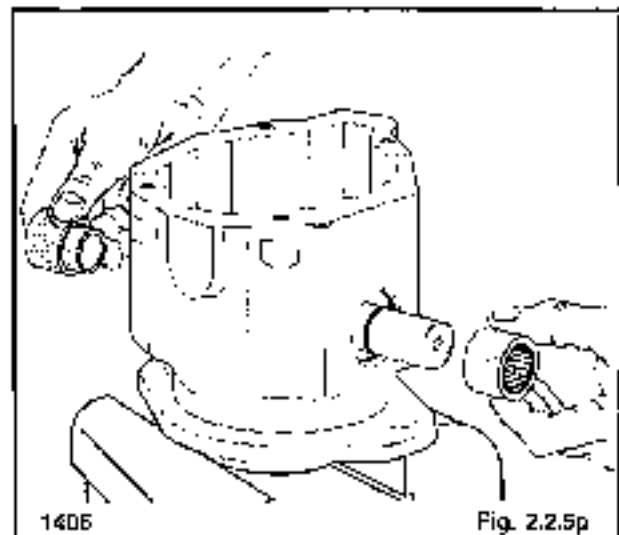
14. Remove the camplate cover plate O-ring and the camplate shaft O-ring (fig. 2.2.5n).



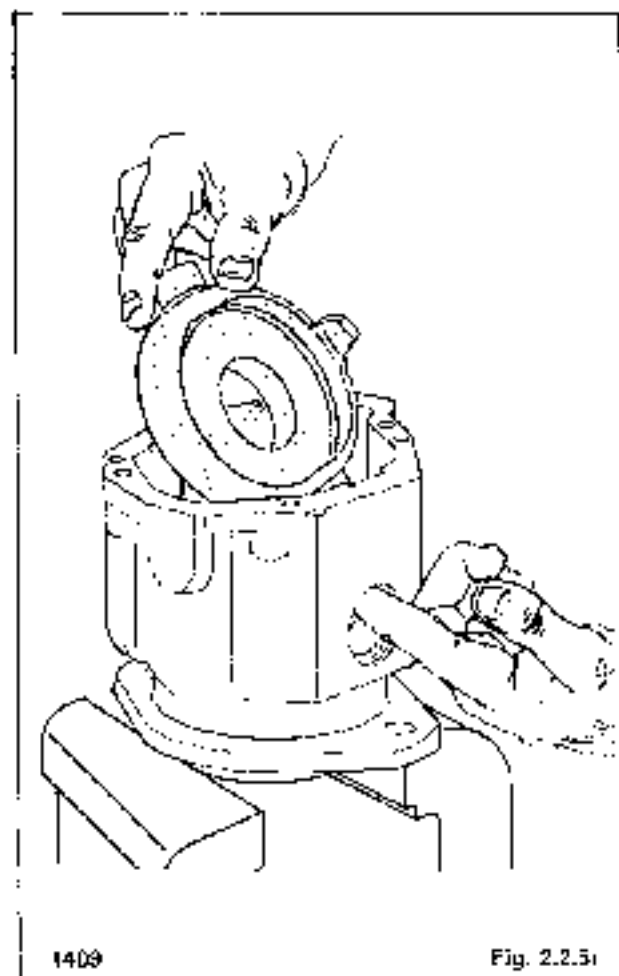
15. Remove the retaining ring, camplate cover and O-ring from the opposite side of the pump housing (fig. 2.2.5o).



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



17. Remove the camplate from the housings (fig. 2.2.5r).



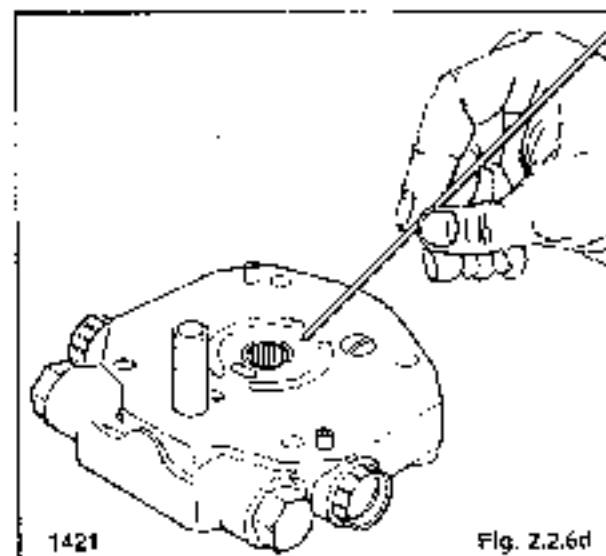
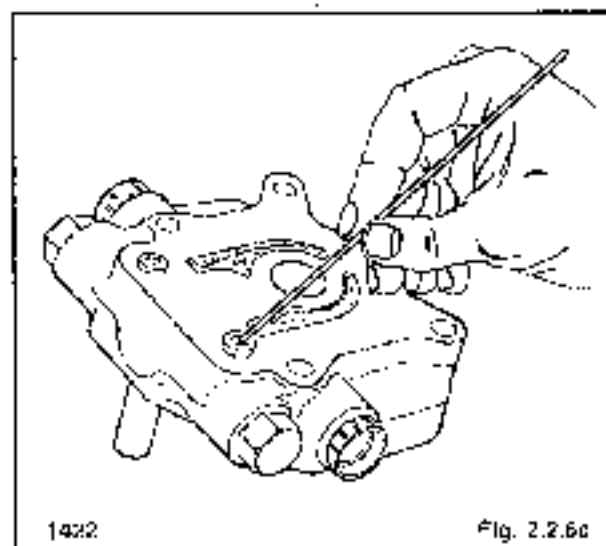
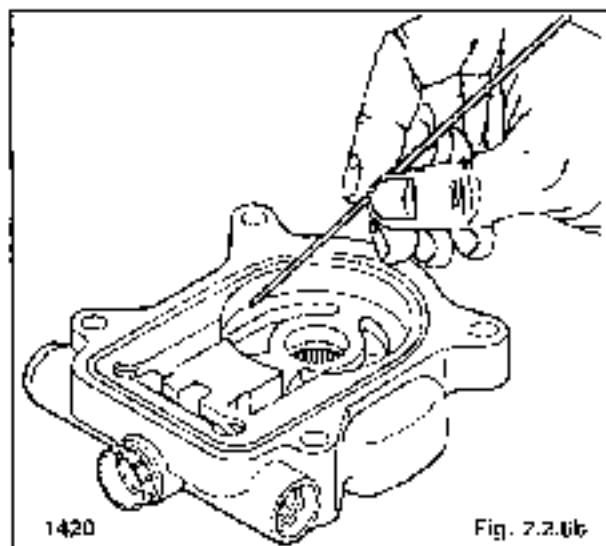
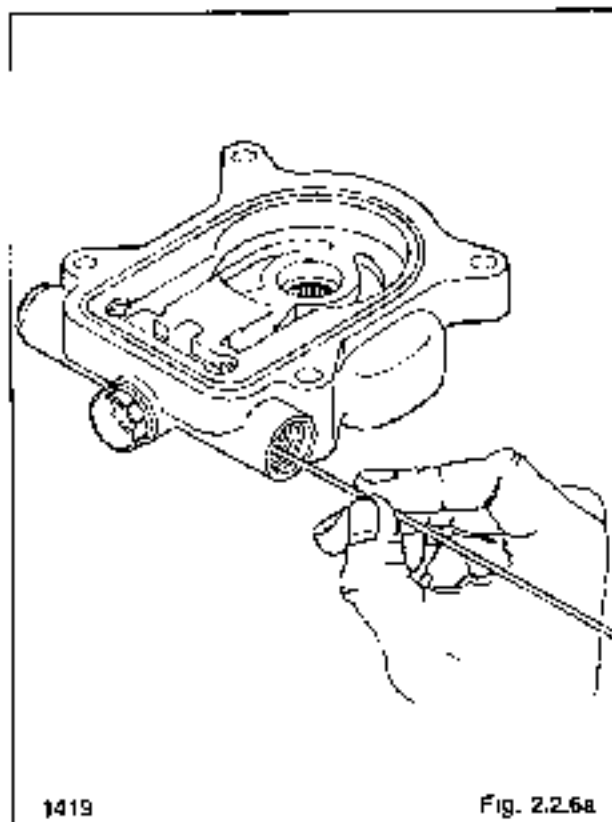
2 HYDROSTATIC DRIVE SYSTEM

2.2.6 Hydrostatic Pump, Inspection:

IMPORTANT

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

1. Inspect the charge pump relief valve seal inside the charge pump adaptor (fig. 2.2.6a). It should be smooth and free from burrs or other defects.
2. Inspect the charge pump spring and poppet for damage.
3. Inspect the gerotor pocket inside the charge pump adaptor plate for excessive scoring or wear (fig. 2.2.6b).
4. Inspect the needle bearing inside the charge adaptor housing. If the needles are free from excessive play and remain in the bearing cage there is no need to replace the bearing.
5. Inspect the check valve assemblies in the back plate (fig. 2.2.6c). Make sure the balls move freely.
6. Inspect the face of the back plate that the charge pump runs against for excessive scoring or wear (fig. 2.2.6c).
7. Inspect the face of the back plate that the rotating group piston block runs against for scoring or wear. The plate should be smooth and free of grooves. If not, replace.



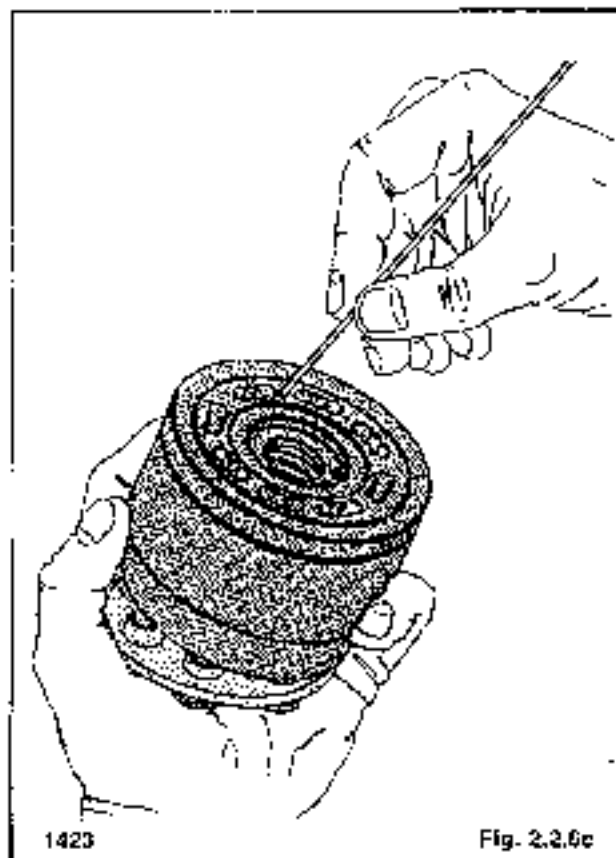
2 HYDROSTATIC DRIVE SYSTEM

8. Inspect the piston block (fig. 2.2.6e). The face that contacts the back plate should be smooth and free from grooves.
9. Inspect the piston block spring and the three pins for damage.



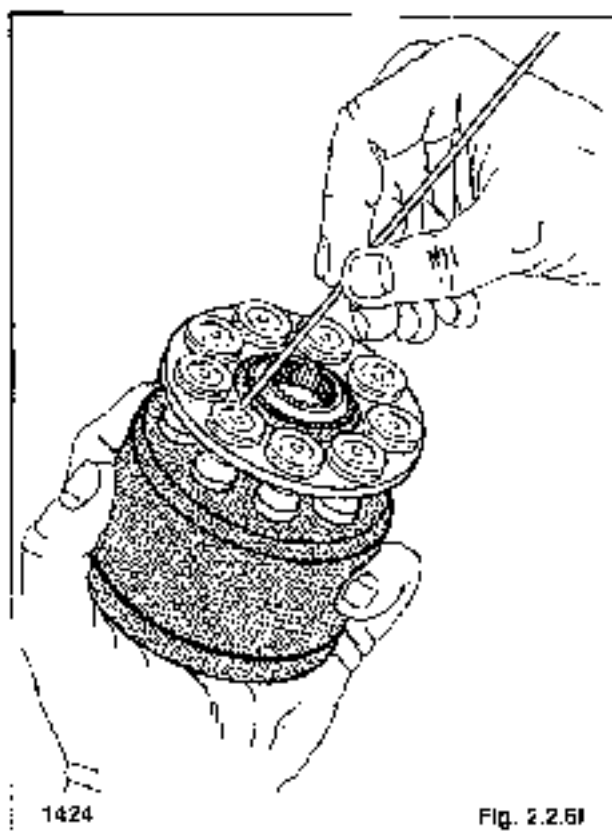
WARNING

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



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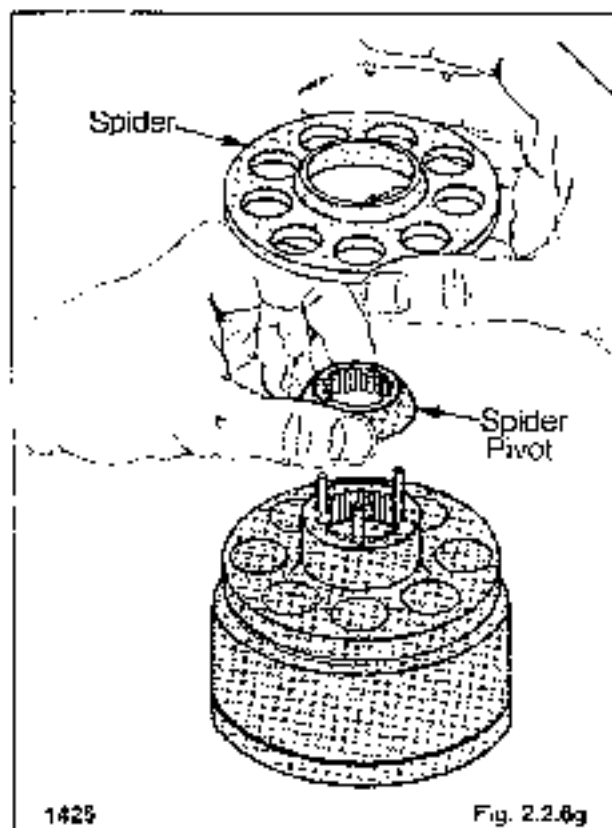
Fig. 2.2.6e



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Fig. 2.2.6f

10. Check that the pistons move freely in the piston block bore (fig. 2.2.6f). If they are sticky in the bore, check the bore for scoring or contamination.
11. Inspect the piston shoes (fig. 2.2.6f). The flat surface of the shoe should be flat and smooth. The corners of the piston shoe should be square and not rounded.
12. Inspect the finish on the outside diameter of the pistons. The surface should be free from scratches or wear.
13. Inspect the spider pivot (fig. 2.2.6g). It should be smooth and show no signs of wear.
14. Inspect the spider (fig. 2.2.6g). It should be flat with no cracks or any signs of wear in the pivot area.

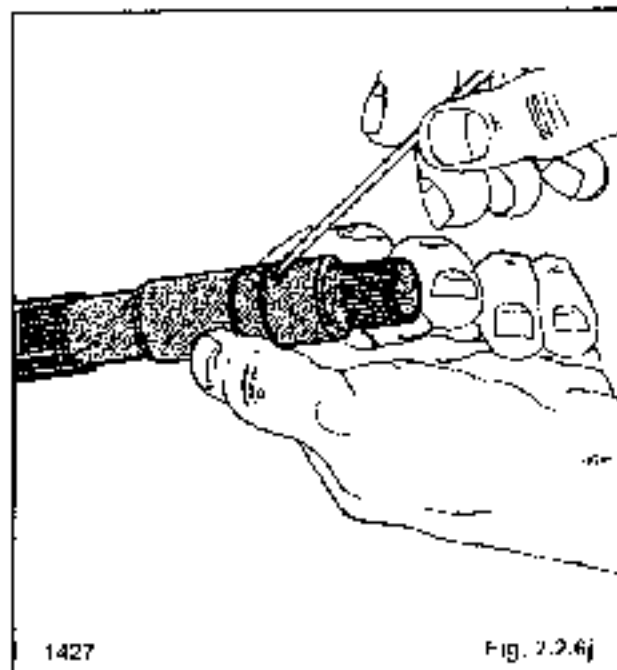
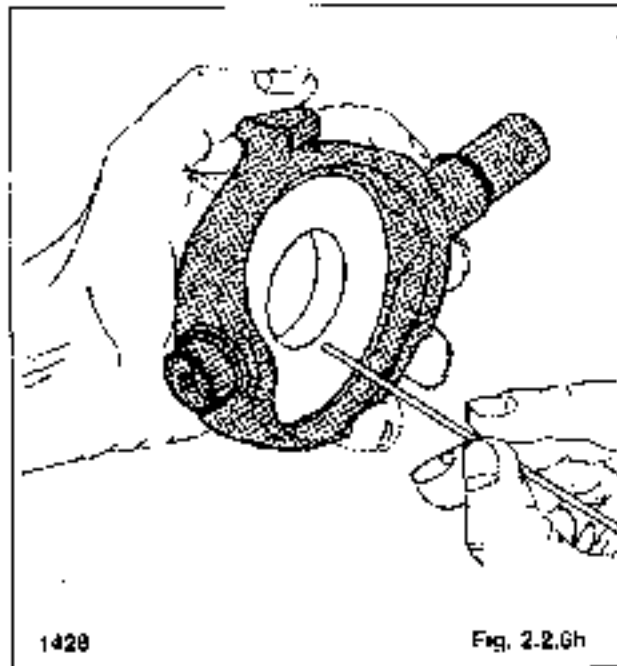


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Fig. 2.2.6g

2 HYDROSTATIC DRIVE SYSTEM

15. Inspect the polished surface of the camplate for scoring (fig. 2.2.6h)
16. Inspect the pump drive shaft bearing surfaces and splines for signs of scoring, wear or any damage (fig. 2.2.6j).
17. Inspect the thrust bearing and washers for wear.
18. 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.



2.2.7 Hydrostatic Pump, Reassembly:

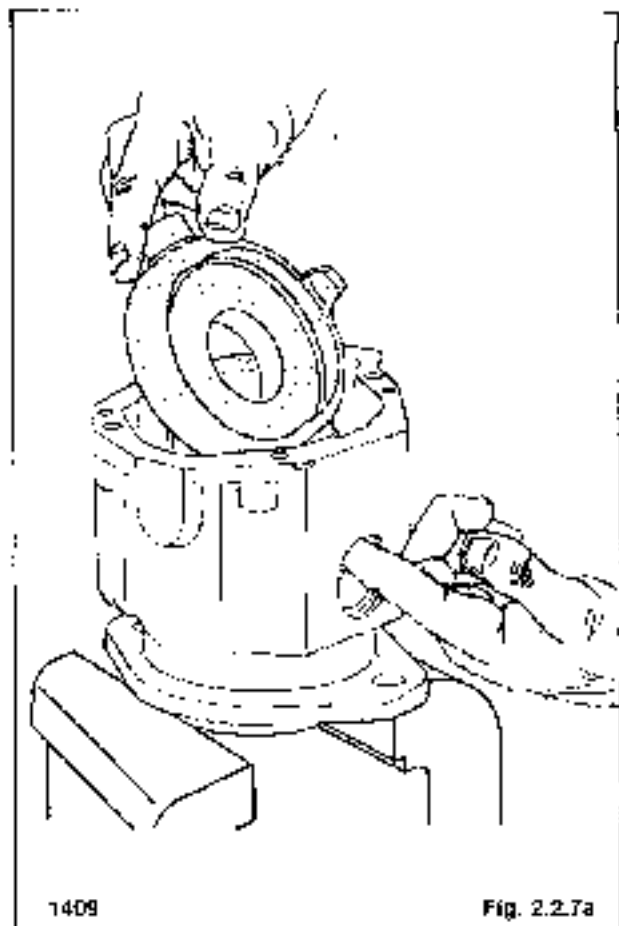
Discard all o-rings, seals and O-rings and replace with new ones on reassembly.

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

IMPORTANT

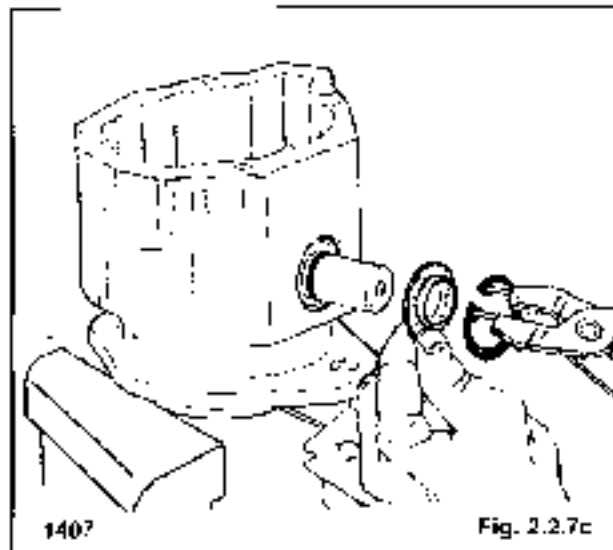
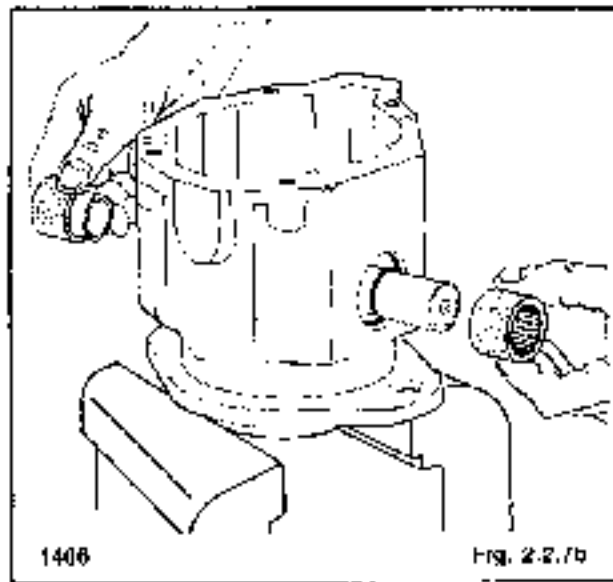
Do not interchange parts from one pump with another. Keep all pump parts separate.

1. Install a new O-ring on the camplate shaft and install the camplate in the pump housing (fig. 2.2.7a)



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.
3. Install new O-rings around the O.D. of the camplate bearings. Install the camplate covers and secure with the retaining rings (fig. 2.2.7c).

2 HYDROSTATIC DRIVE SYSTEM

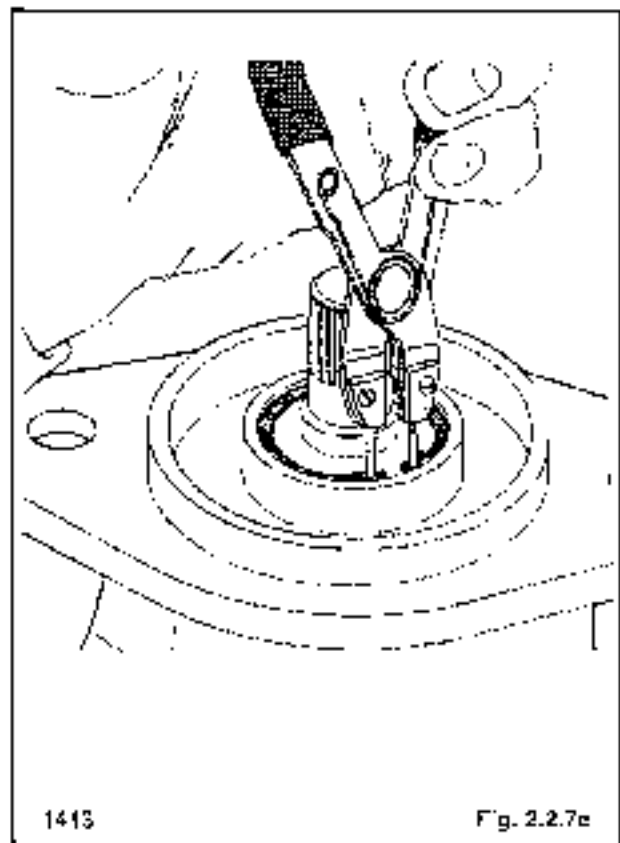
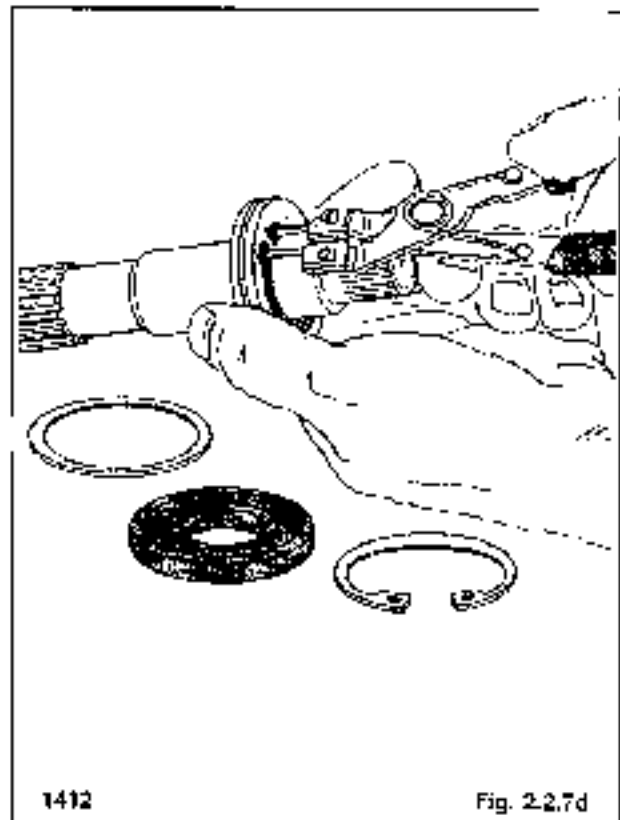


4. Install the thrust bearing and races on the pump shaft and secure with the retaining ring (fig. 2.2.7d). Install the shaft in the pump housing.
5. Install the shaft seal spacer washer and a new shaft seal in the housing. Secure in place with the retaining ring (fig. 2.2.7e).
6. If the piston block has been disassembled, install the 2 pins, washers and spring. Compress the spring and install the retaining ring (fig. 2.2.7f).



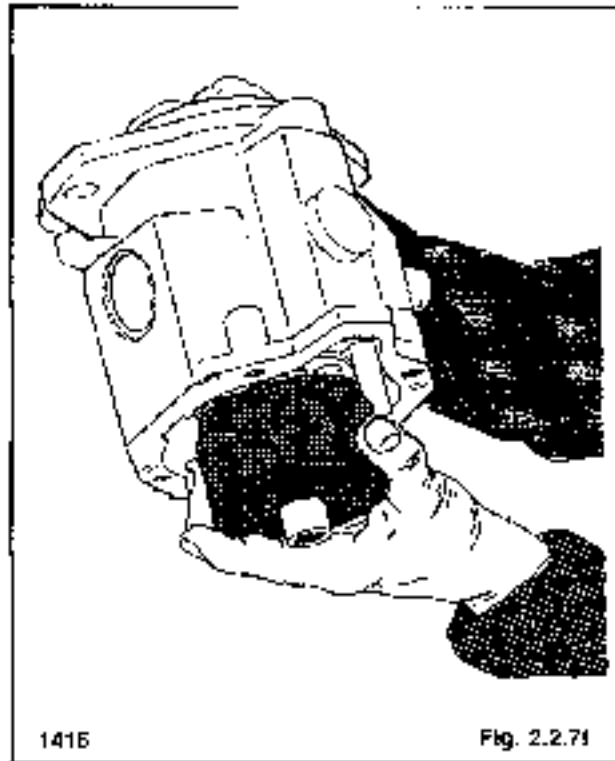
WARNING

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

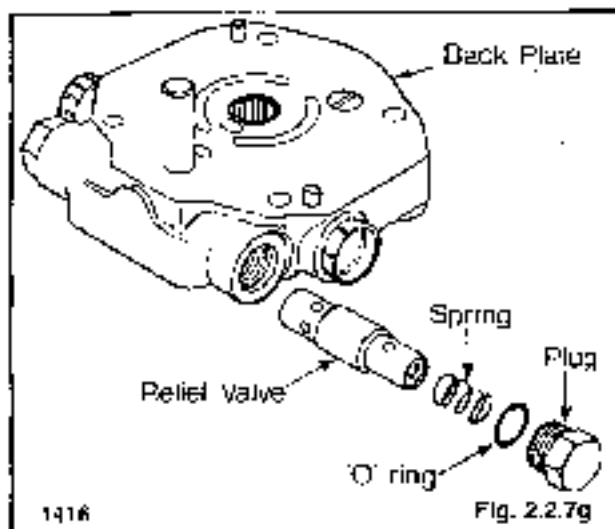


2 HYDROSTATIC DRIVE SYSTEM

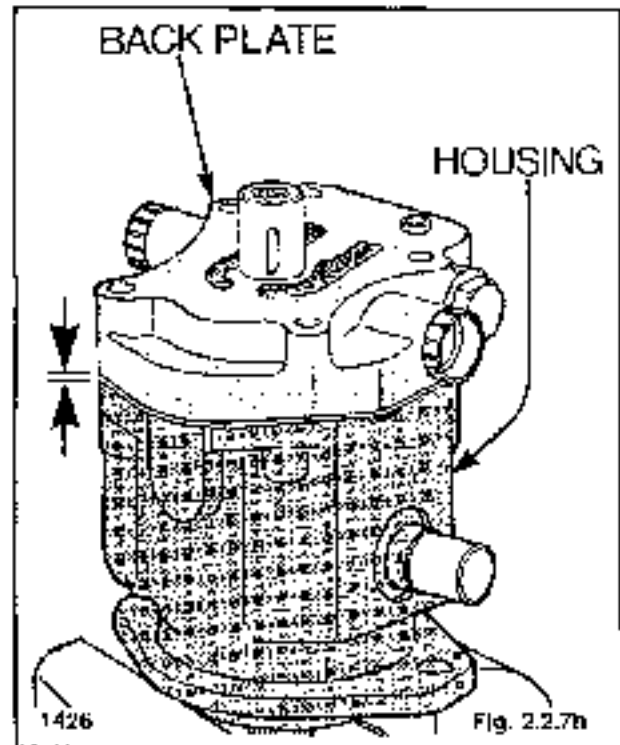
7. Install the spider pivot, spider and the pistons in the piston block. Install the piston block in the housing (fig. 2.2.7f). Line up the spline on the piston block with the spline on the pump shaft. Ensure the piston shoes come in contact with the camplate. The piston block will extend slightly beyond the housing when installed.



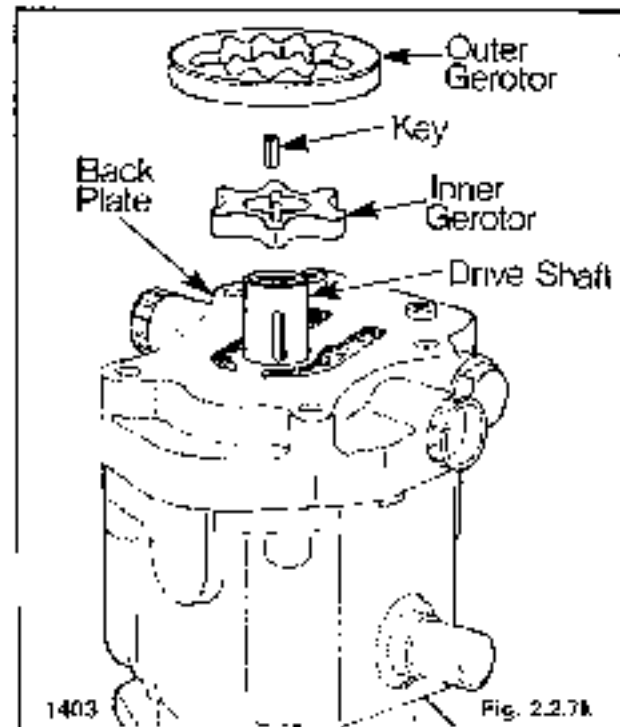
8. Install a new gasket on the housing.
9. Install the two relief valves and springs into the back plate assembly (fig. 2.2.7g). Place a new O-ring on the plugs and torque the plugs to 55-60 ft lbs (75-81.3 N.M.).



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

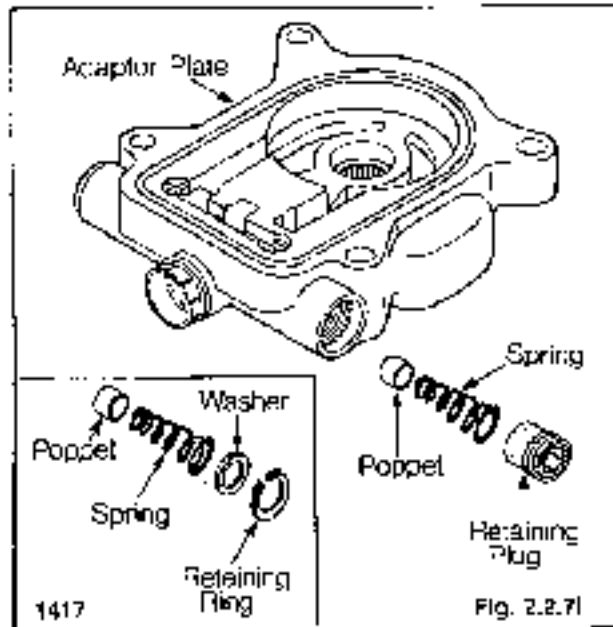


11. Install the charge pump assembly on the back plate (fig. 2.2.7k).

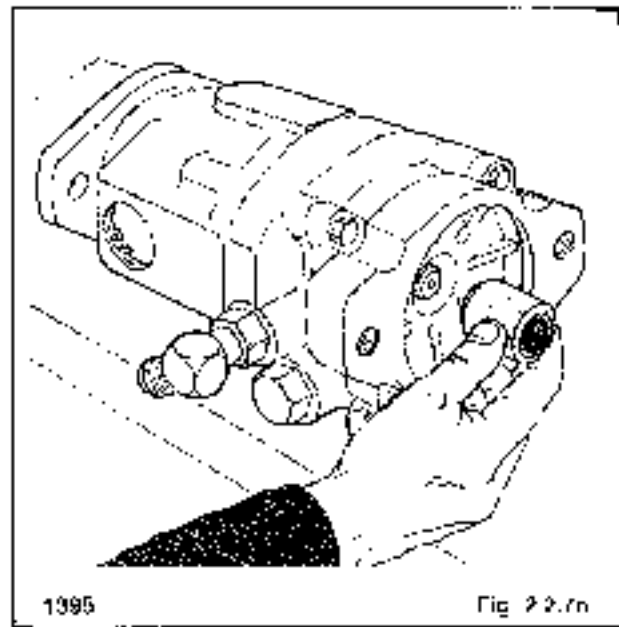


2 HYDROSTATIC DRIVE SYSTEM

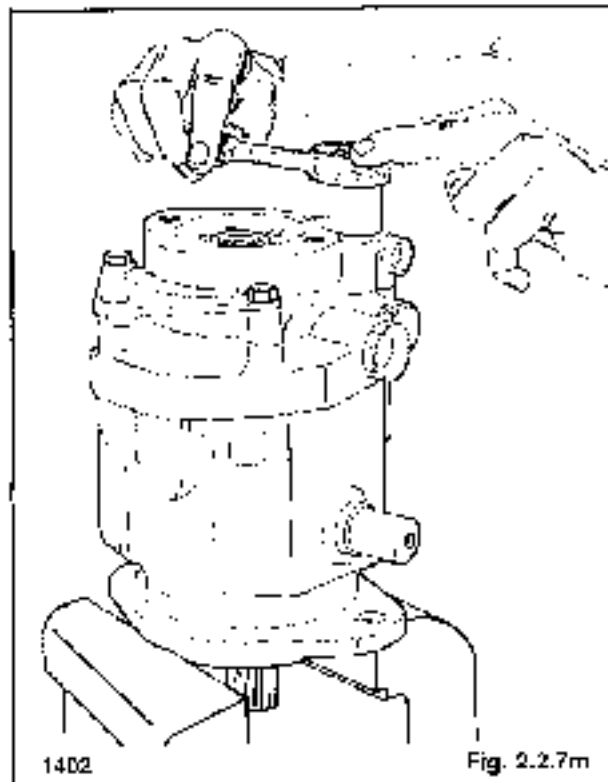
- 12 Install the charge pump roller valve in the adaptor plate (fig. 2.2.7i).



- 14 Install the splined drive coupler in the rear piston pump (fig. 2.2.7n).



13. Install a new O-ring in the groove on the adaptor plate and install the adaptor plate on the back plate. Torque the cap screws to the following (fig. 2.2.7m).
27-31 ft. lbs (38.6-42 N.M.)



IMPORTANT

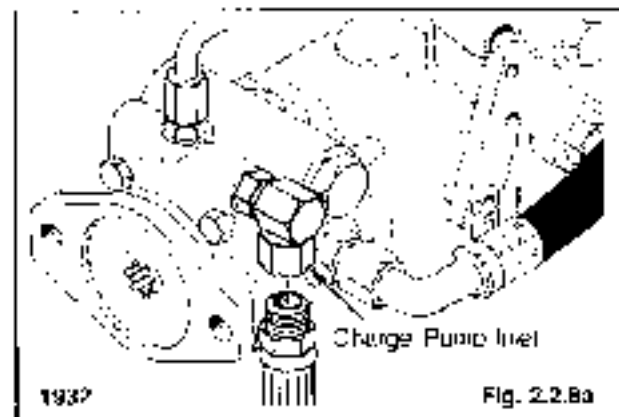
When making repairs to the hydrostatic system, keep all parts clean, and remove dirt from the work area. Use caps and plugs on all lines and openings.

2.2.8 Charge Pump Removal:

The hydrostatic charge pump can be inspected and repaired without removing the front hydrostatic pump from the loader.

Discard all seals and replace as new upon reassembly.

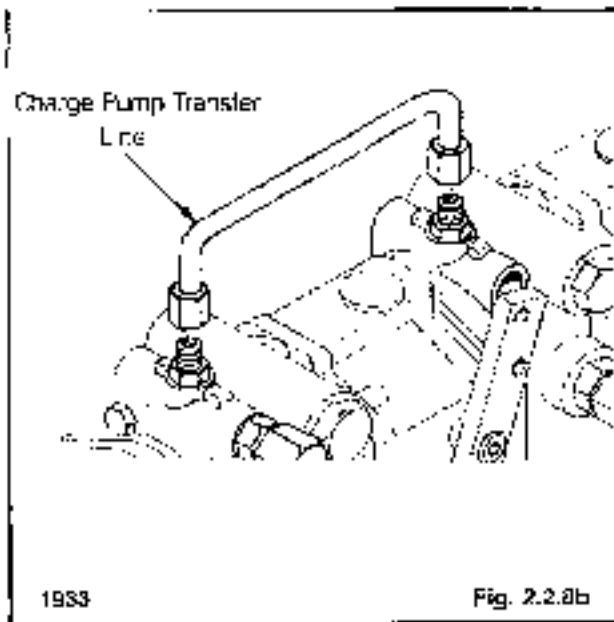
- 1 Remove the hydraulic gear pump from the front hydrostatic pump. Refer to section 1.2.4 for procedure.
- 2 Remove the hydraulic hose from the charge pump inlet port (fig. 2.2.8a). Plug the inlet port and cap the hose.



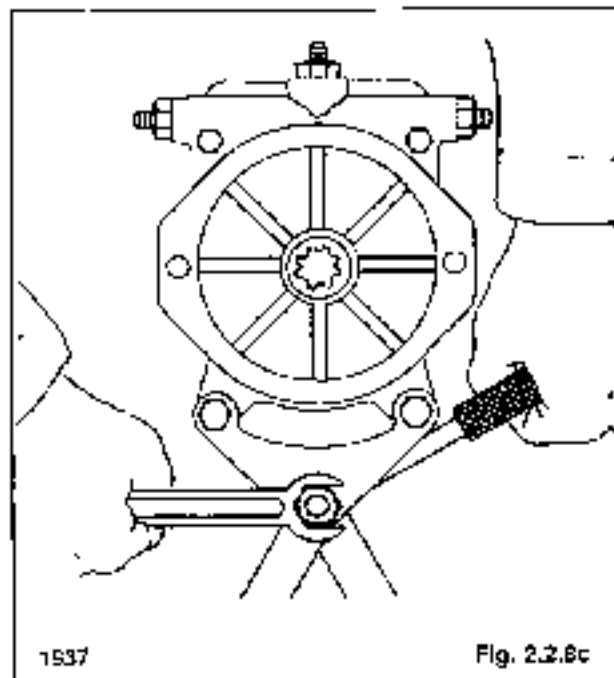
2 HYDROSTATIC DRIVE SYSTEM

- 3 Disconnect and remove the charge pump transfer line between the front and rear pumps (fig. 2.2.8b).

Cap the transfer line and pump ports

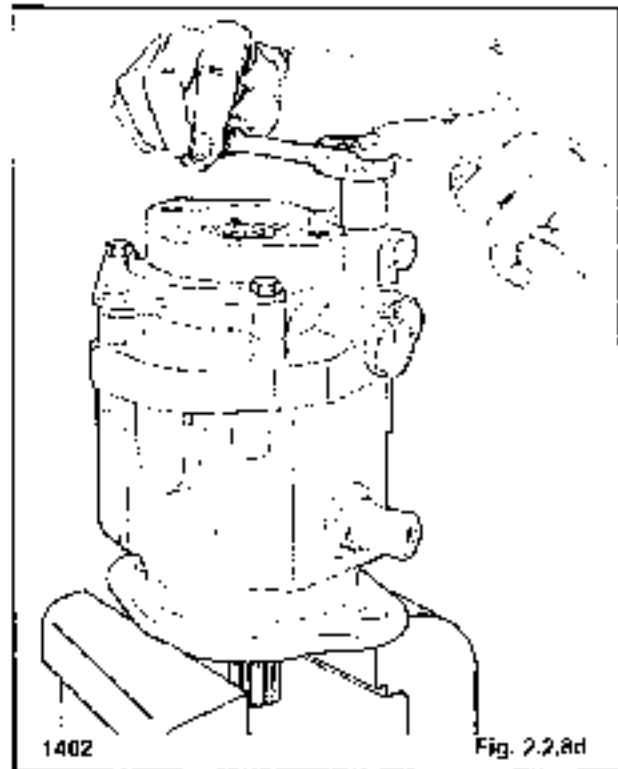


- 4 Remove the bolt from the front pump mounting bracket (fig. 2.2.8c).



- 5 Remove the four bolts and pump mounting bracket from the front pump (fig. 2.2.8d).

On reassembly torque the mounting bolts 27-31 lbf (36.6-42 N.M.).



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

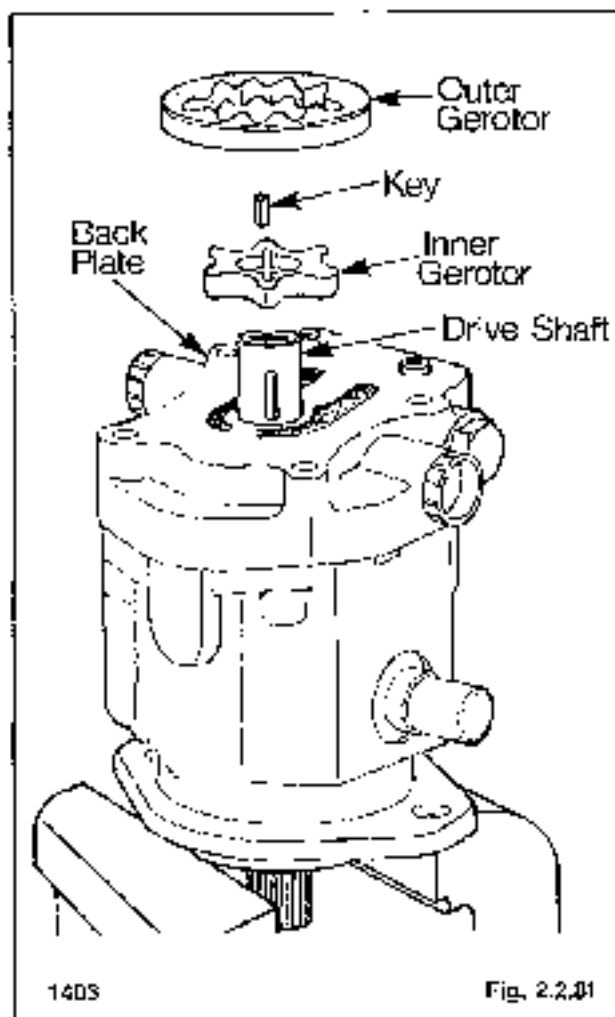
Remove the adaptor plate from the pump assembly



On reassembly install a new adaptor plate O-ring

2 HYDROSTATIC DRIVE SYSTEM

7. Remove the charge pump assembly from the back plate (fig. 2.2.8f).

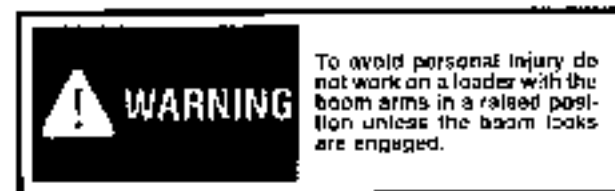


2.2.9 Camplate — Seal Replacement:

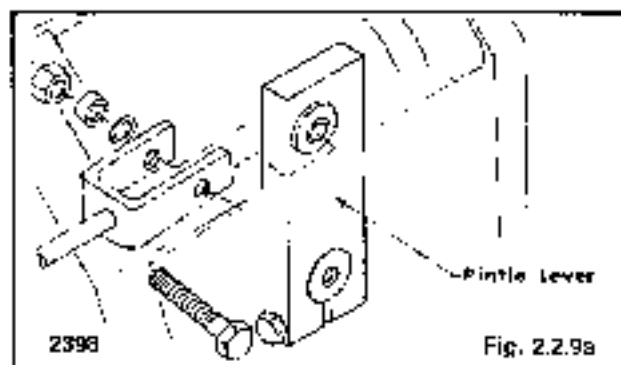
The hydrostatic pump camplate seals can be replaced without removing the hydrostatic pump from the loader.

Discard all seals and replace as new upon reassembly.

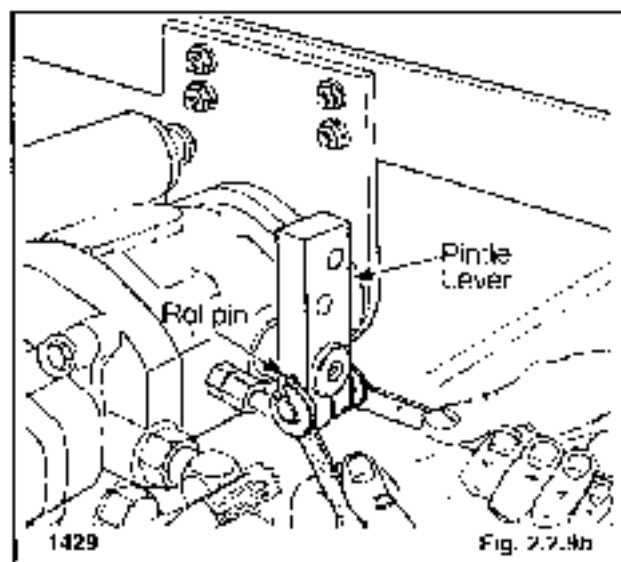
1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.



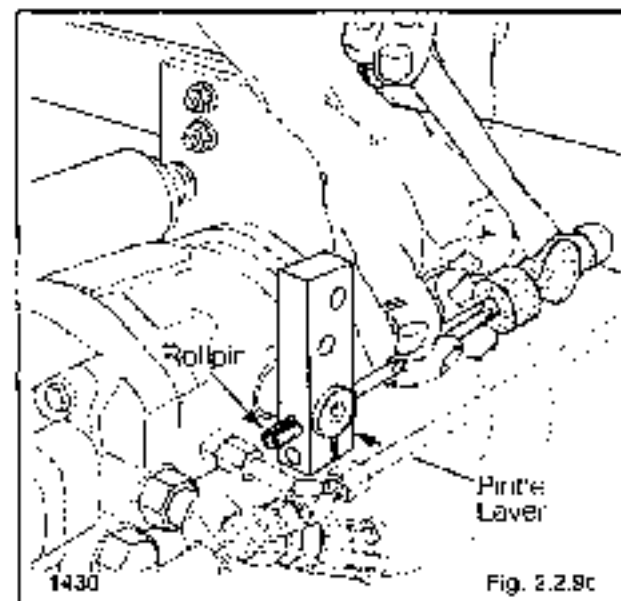
2. Remove the seal.
3. Disconnect the steering control linkage from the pump pintle lever (fig. 2.2.9a).



4. Remove the clamp bolt from the bottom of the pintle lever (fig. 2.2.9b).

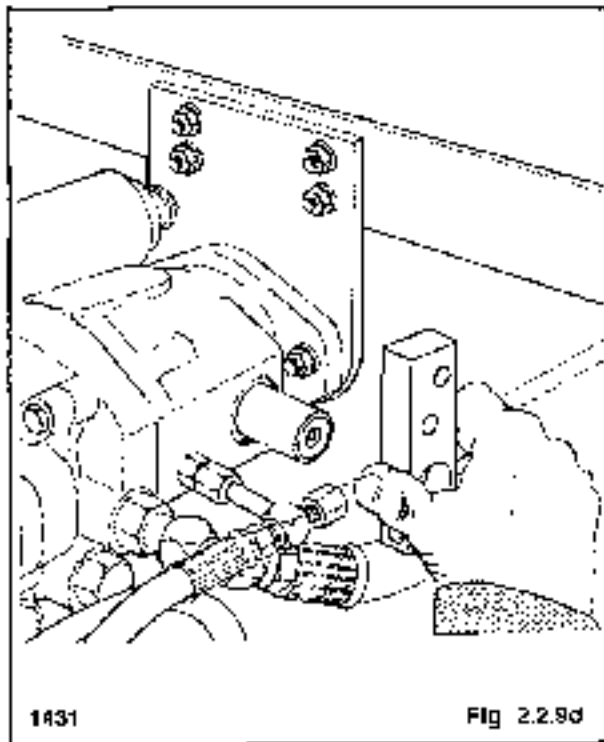


5. Remove the roll pin from the pintle lever (fig. 2.2.9c).

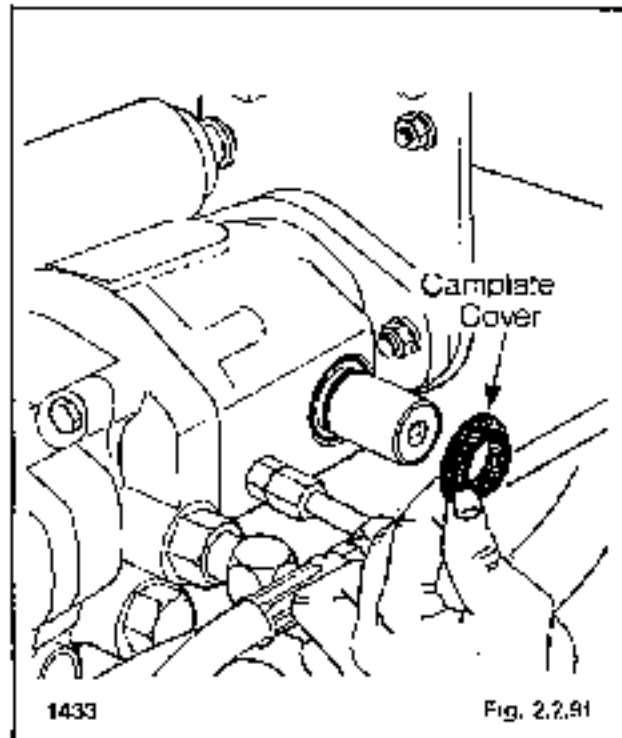


2 HYDROSTATIC DRIVE SYSTEM

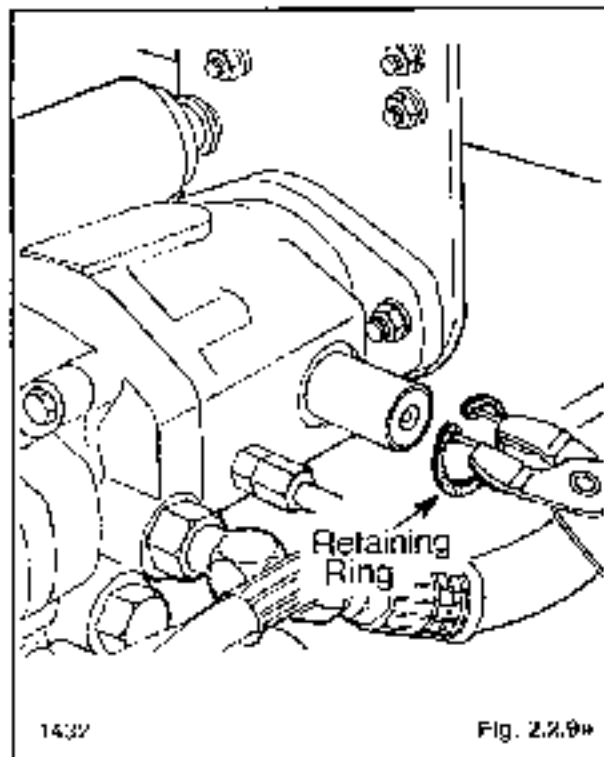
6. Remove the pin-like lever from the camplate shaft (fig. 2.2.9d).



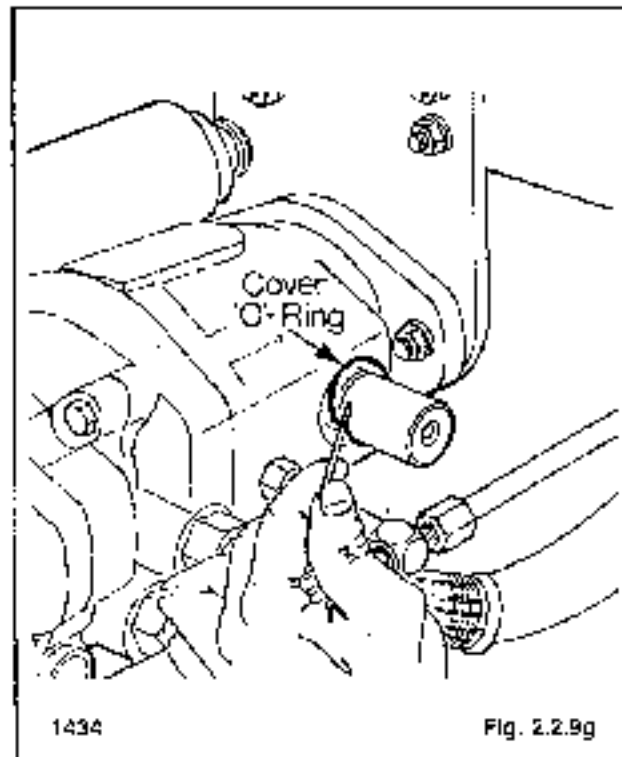
8. Remove the camplate cover (fig. 2.2.9f).



7. Remove the retaining ring holding the camplate cover in place (fig. 2.2.9e).

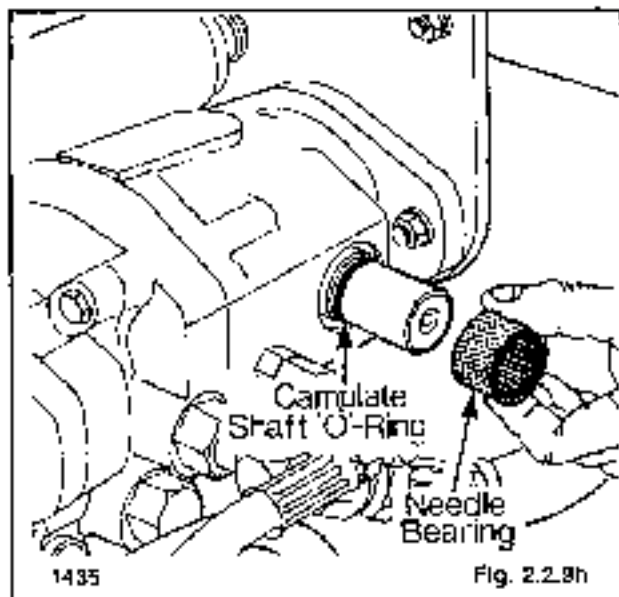


9. Remove the camplate cover O-ring (fig. 2.2.9g).
On reassembly install a new O-ring.



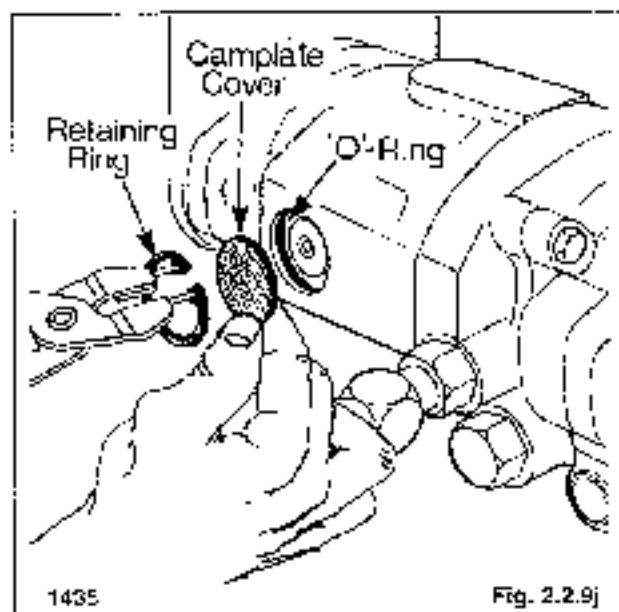
2 HYDROSTATIC DRIVE SYSTEM

10. Remove the needle bearing from the camplate shaft (fig. 2.2.9h).



The needle bearing is a slip fit into the housing. On reassembly the numbered end of the bearing should face outward.

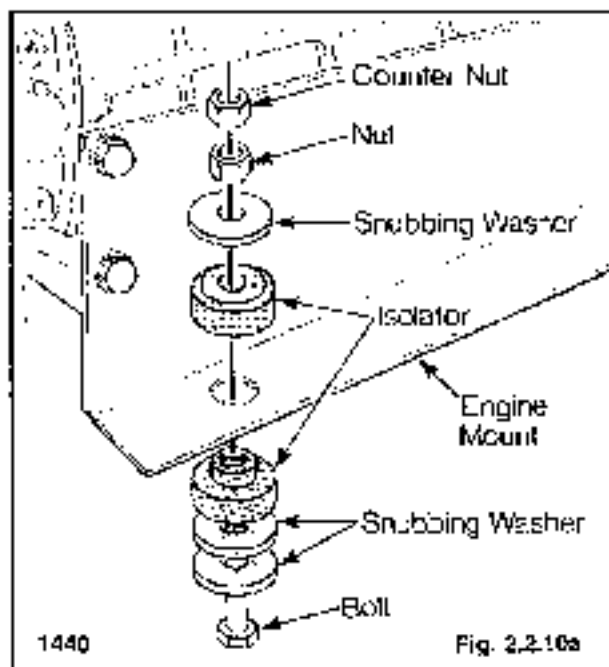
11. Remove the camplate shaft O-ring (fig. 2.2.9i).
On reassembly install a new O-ring.
12. Remove the retaining ring and camplate cover from the opposite side of the pump housing (fig. 2.2.9j).



13. Remove the camplate cover O-ring (fig. 2.2.9k).
On reassembly install a new O-ring.

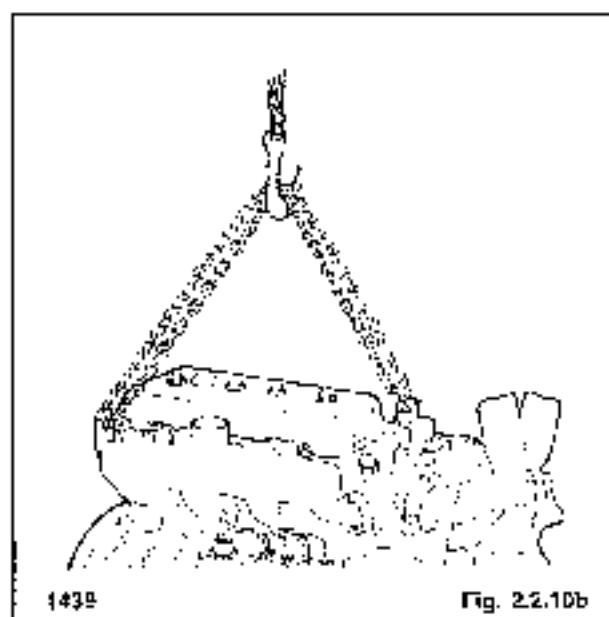
2.2.10 Rear Pump — Shaft Seal Replacement

1. Disconnect the exhaust pipe and air intake from the engine.
2. Remove the engine mounting bolts and conenuts from the engine (fig. 2.2.10a).



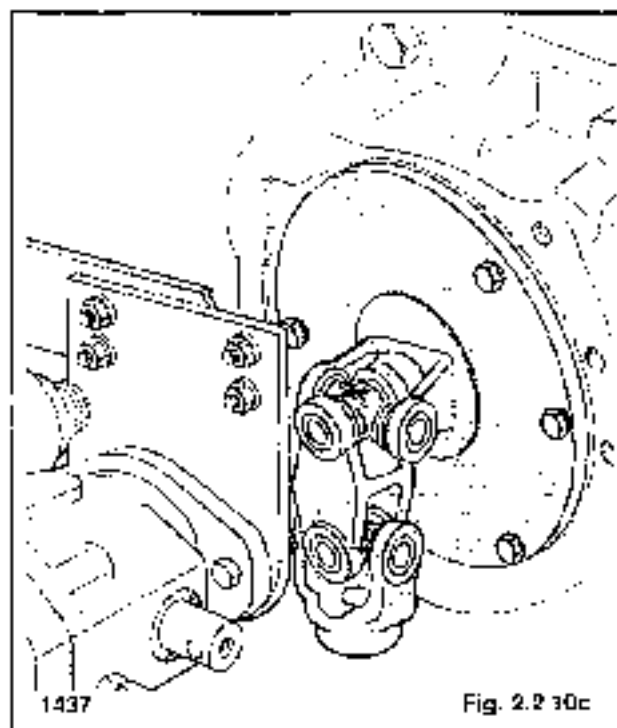
NOTE: On reassembly torque the mounting nut to 40 ft. lbs. (54 N.M.). Torque the conenut against the mounting nut 80 ft. lbs. (108.5 N.M.). Do not overtorque the mounting nut.

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

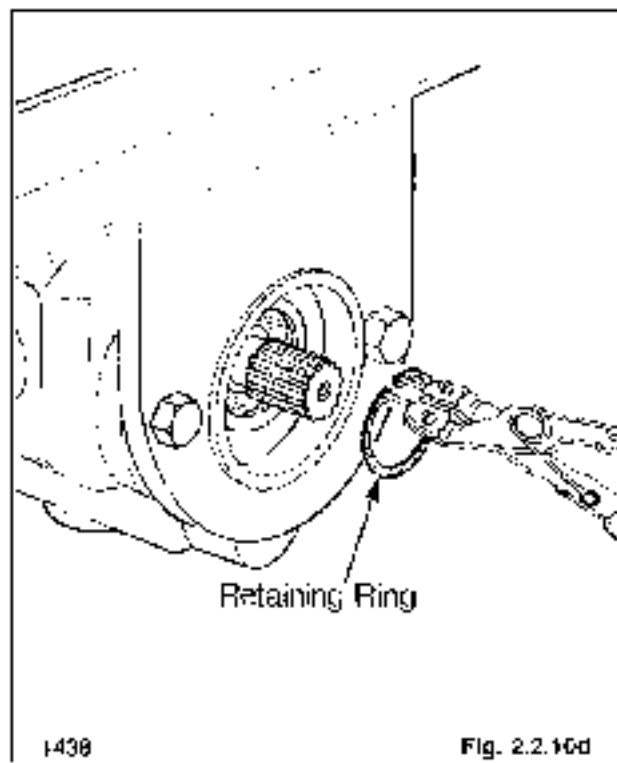


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4. Using a chain hoist lift the engine and move it toward the rear of the loader until the universal joint slides off the end of the rear pump shaft (fig. 2.2.10c).

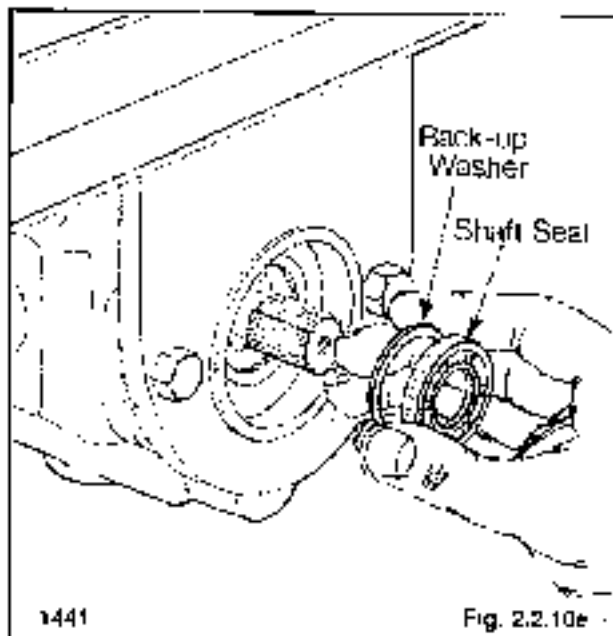


5. Remove the retaining ring from the hydrostatic pump (fig. 2.2.10d).



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

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.

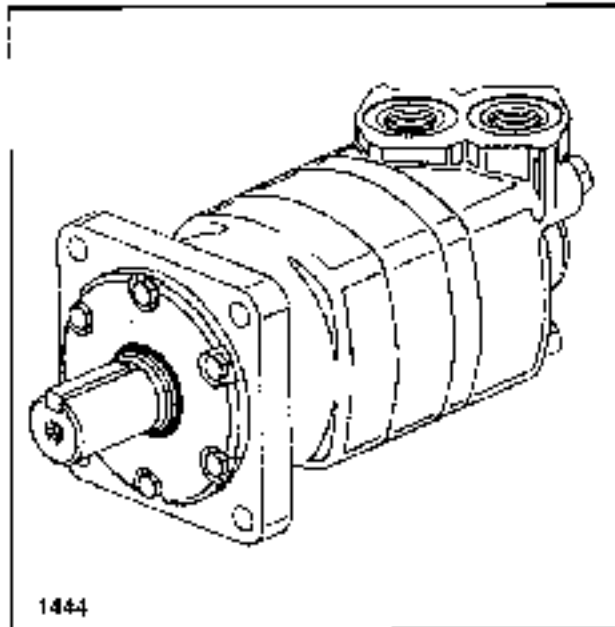


7. Lubricate a new pump shaft seal with system fluid and install it in the pump.

NOTE: On reassembly torque the mounting nut to 40 ft. lbs. (54 N.M.). Torque the counter nut against the mounting nut 80 ft. lbs. (108.5 N.M.). Do not over torque the mounting nut.

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2.3 TORQUE MOTOR



2.3.1 Specifications:

Motor type	Geroler
Displacement	11.9 cu. in. (195 cm ³)
Rotation	Dual
Section bolt torque	82.5 ft. lbs. (64.7 N.M.)
Retainer cover bolt torque	25 ft. lbs. (35.0 N.M.)
Mounting nut torque (in pairs)	100-110 ft. lbs. (135-149 N.M.)
Sprocket nut torque	350 ft. lbs. (475 N.M.)

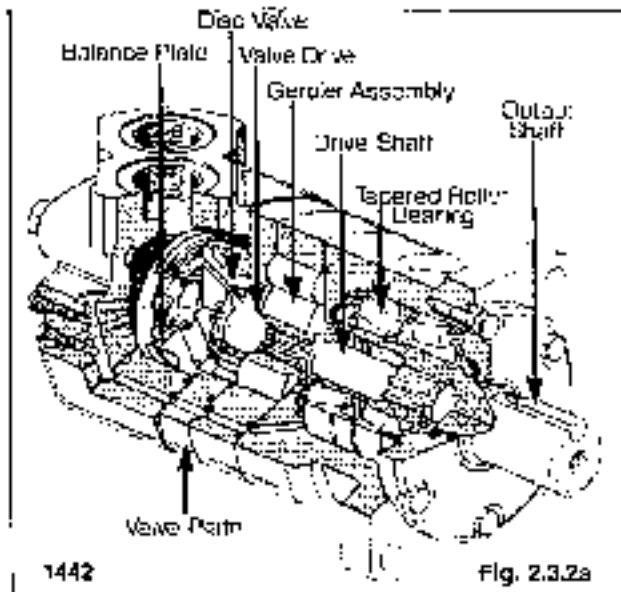
2.3.2 General Information:

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

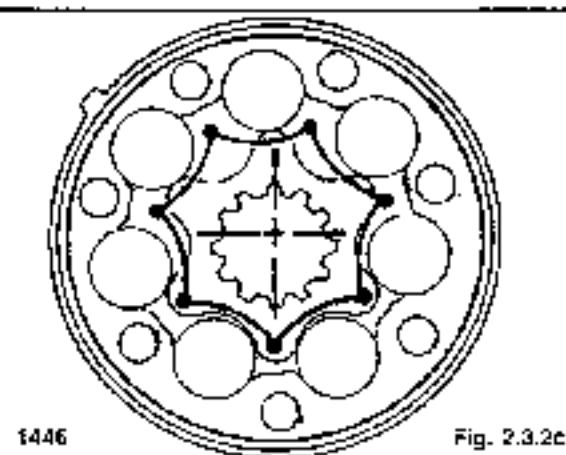
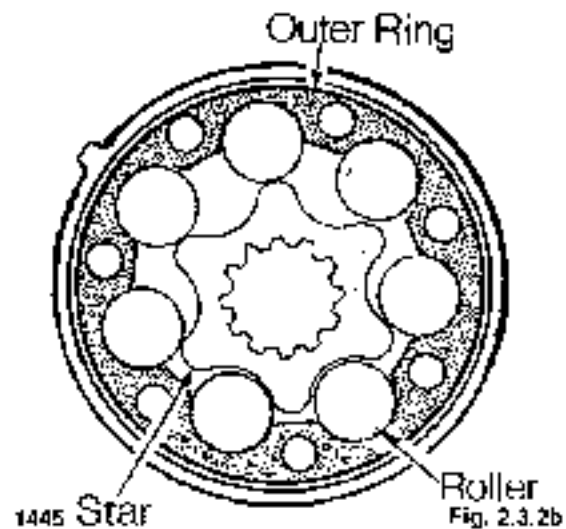
The outer ring (fig. 2.3.2b) of the geroler assembly is similar to an internal gear that is held in a fixed position by securing it to the motor housing. The rotating inner gear, called a star, orbits inside the secured outer ring.

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.



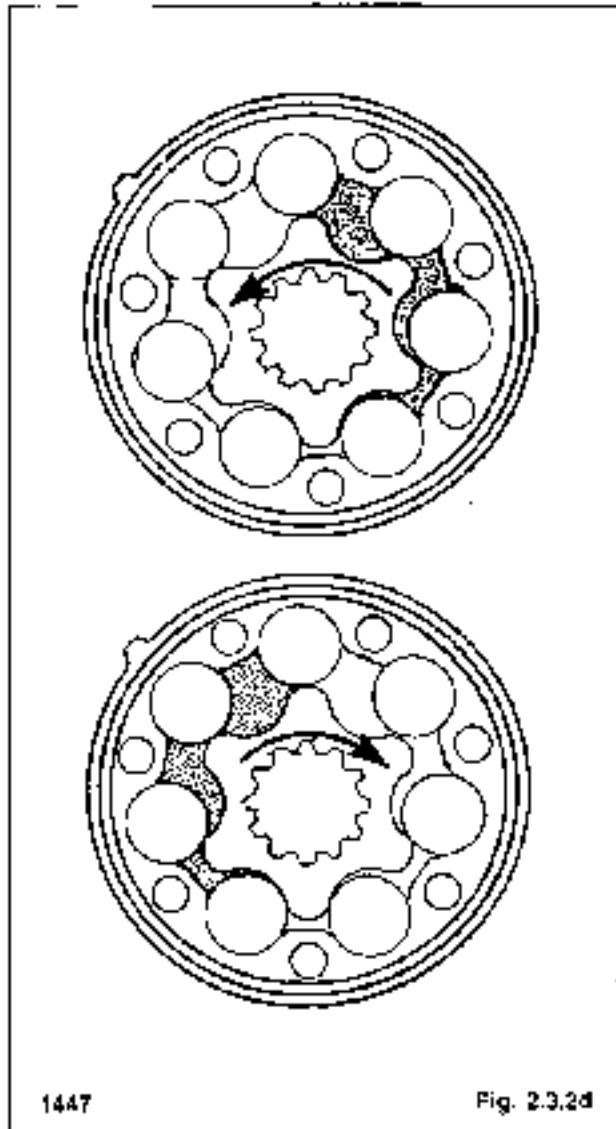
GEROLER ASSEMBLY:



2 HYDROSTATIC DRIVE SYSTEM

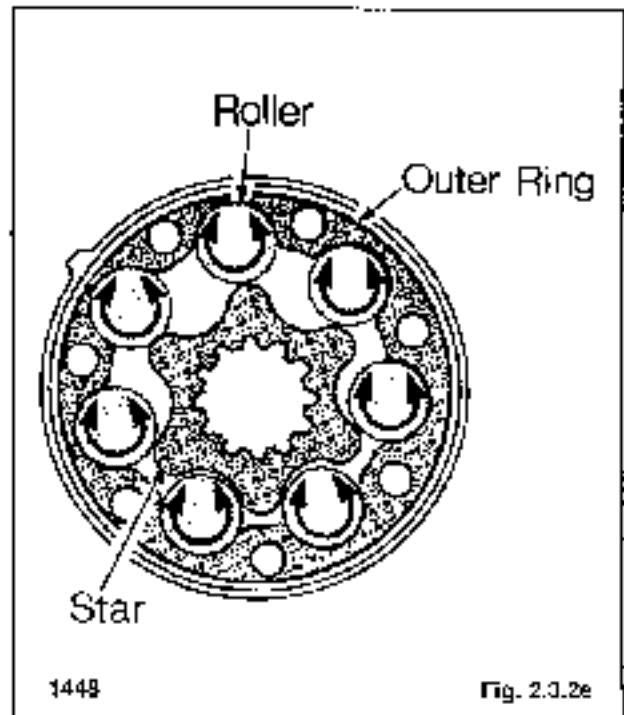
As the star orbits it, it causes a continuous opening and closing of the outer ring fluid pockets. Half of these fluid pockets are subject to fluid pressure, causing star rotation, and the opposing half are connected to a return line.

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.

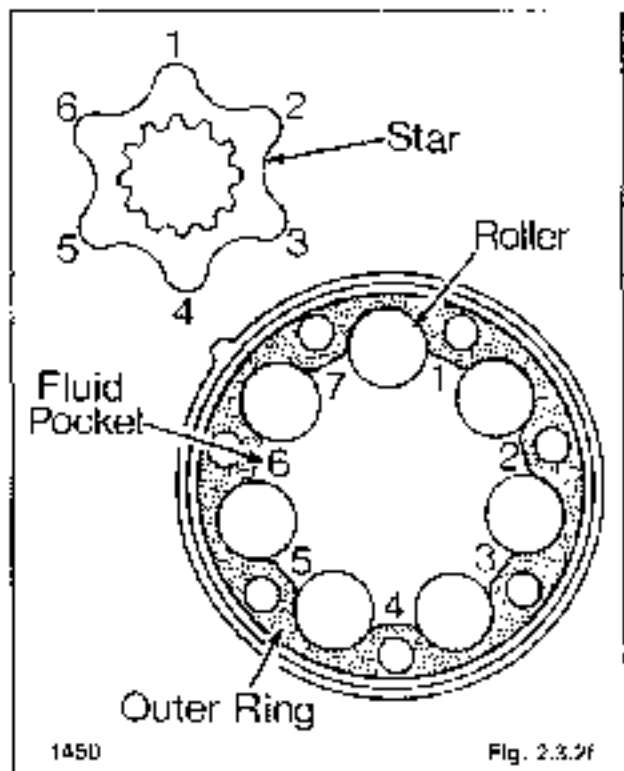


To seal the fluid pockets the torque motor incorporates a rotating roller type seal (fig. 2.3.2e). This type of a rolling seal reduces friction at the star points providing increased efficiency and reduced component wear.

The gearstar (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. Verses a

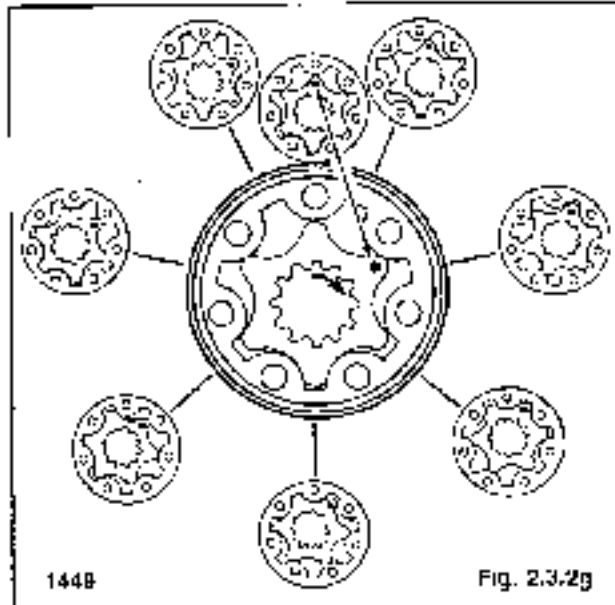


piston type motor. This means that six times greater torque can be developed at one-sixth the speed without further gear reduction.

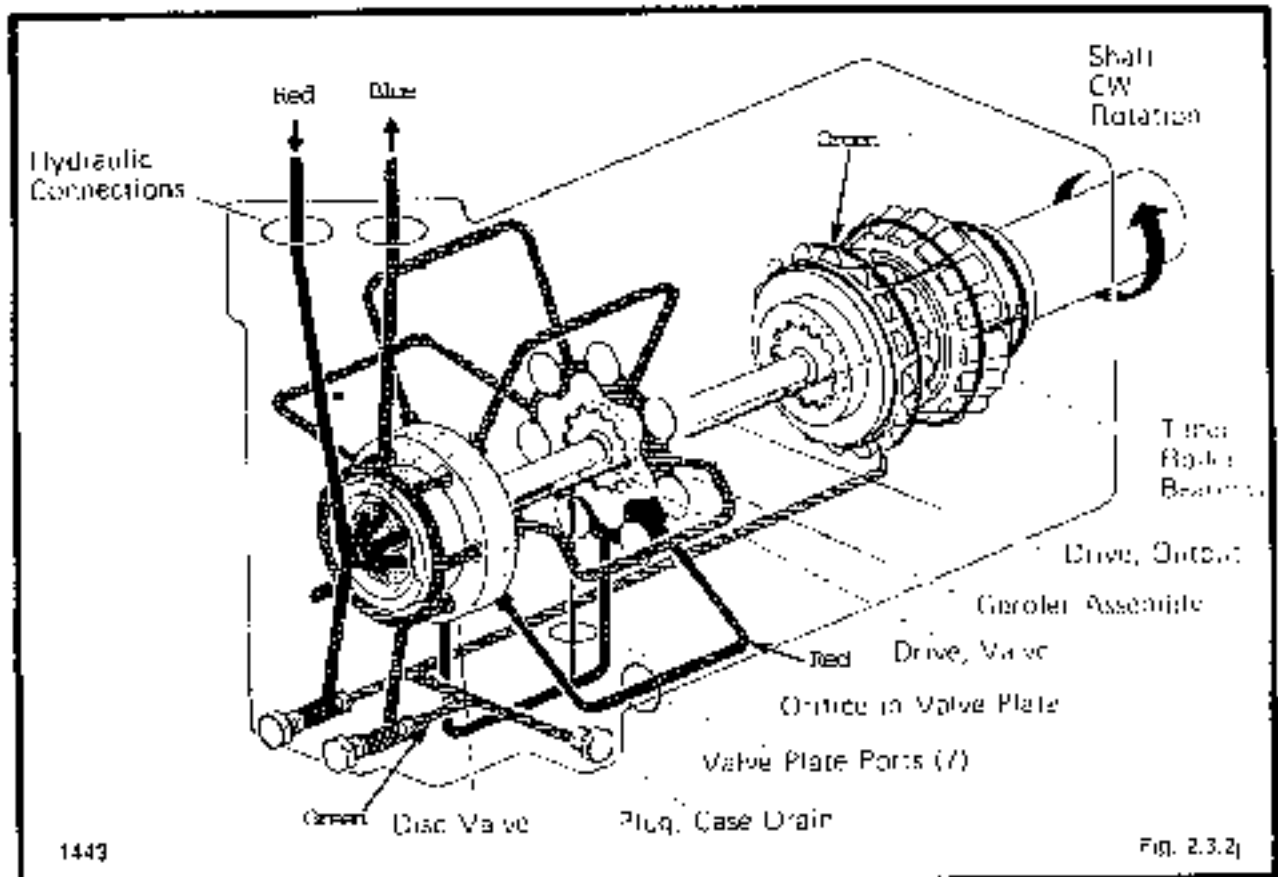
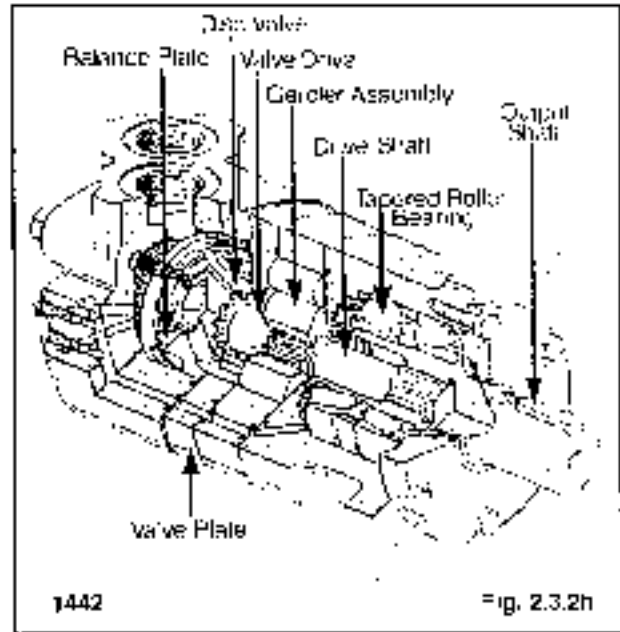


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Shown in figure 2.3.2g is one complete star orbit or one-sixth of the output shaft rotation. The star must travel through six complete orbits for each single rotation of the output shaft creating a speed reduction of six to one. The use of seven fluid 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 valve which operates in synchronization with the gear-like star. The disc valve arrangement consists of a stationary balance plate, rotating disc valve and a stationary valve plate (fig. 2.3.2h).



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The disc valve contains an inlet fluid passage port for each star valley area and a return fluid passage port. A separate crowned drive shaft is used to synchronize the disc valve and gearler 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.

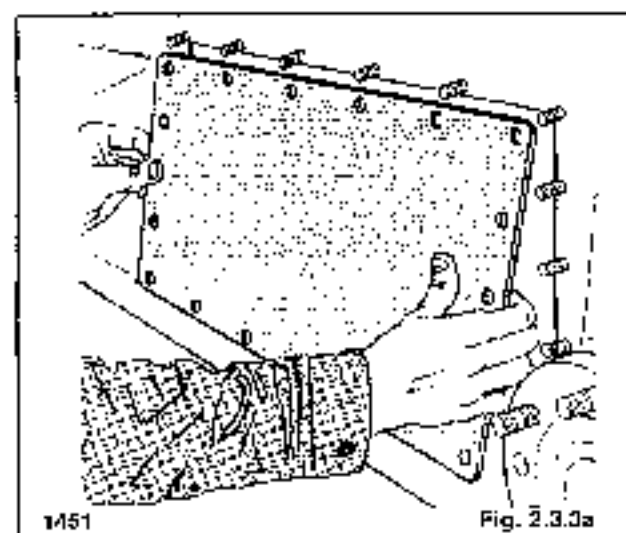
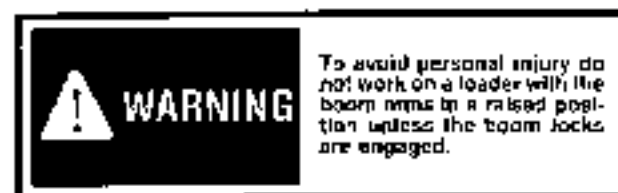
Fluid enters the housing through the inlet port and is directed to the balance plate. The balance plate contains an inner and outer seal to separate the high and low pressure fluid passages. Fluid passes through the stationary balance plate to the rotating disc valve. The rotating disc valve ports the fluid to the stationary valve plate and proper ends of the gearler 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.

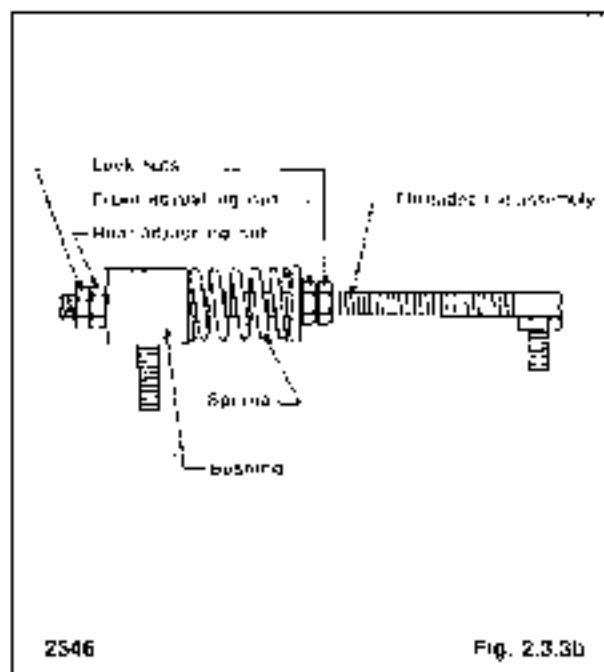
The disc valve is timed to the gearler rotor star to govern the net fluid flow to output shaft rotation. If the timing of the disc valve to gearler star is off one tooth, the relationship of input fluid flow to output motor shaft rotation will be reversed.

2.3.3 Torque Motor Removal:

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



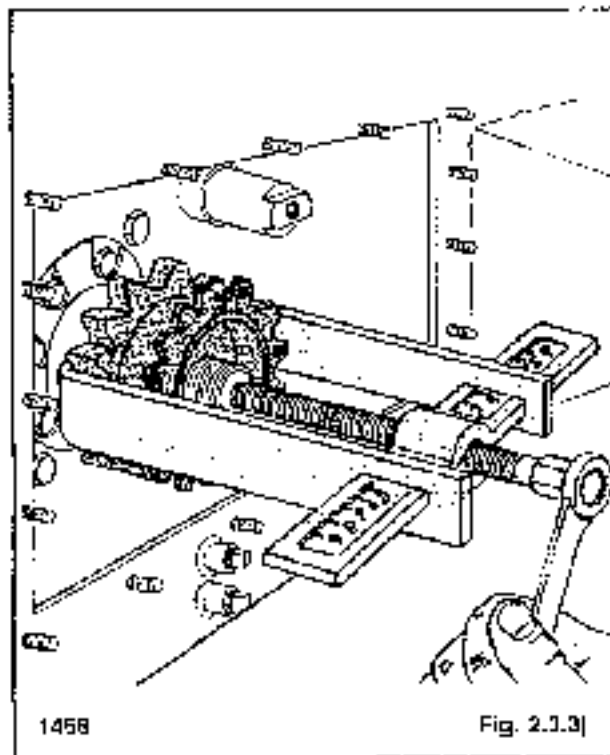
2. Block the loader securely with all four wheels clear of the ground.
3. Remove the wheels on the side of the machine that the torque motor is to be removed from.
4. Drain the hydraulic reservoir. (Refer to section 1.6.3 for procedure).
5. Drain the lubricating oil from the final drive housing (Refer to section 3.1.4 for procedure).
6. Remove the final drive inspection plate cover (fig. 2.3.3a) located between the axles on the final drive housing.
7. Remove bolt end of threaded rod assembly from brake lever on caliper (fig. 2.3.3b).



8. Loosen brake caliper assembly.
9. Remove stainless steel 1/2" pin and lock washers from torque motor sprocket.
10. Spread the brake pads apart to allow removal of the brake disc.
11. Remove primary chain. Refer to section 3.2.2 for procedure.
12. Remove castle nut.
13. Using a proper gear puller, remove the sprocket and key from the torque motor shaft (fig. 2.3.3j).

NOTE: The torque motor can be removed from the final drive housing with the sprocket mounted on the motor shaft.

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Fig. 2.3.3j

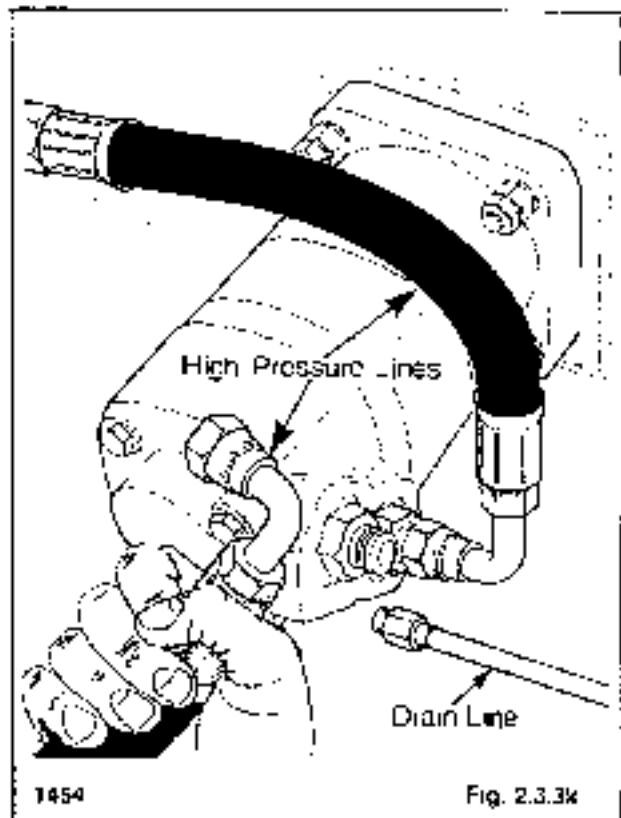
14. Disconnect and remove the two high pressure pipes between the pump and motor (fig. 2.3.3k).

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

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

IMPORTANT

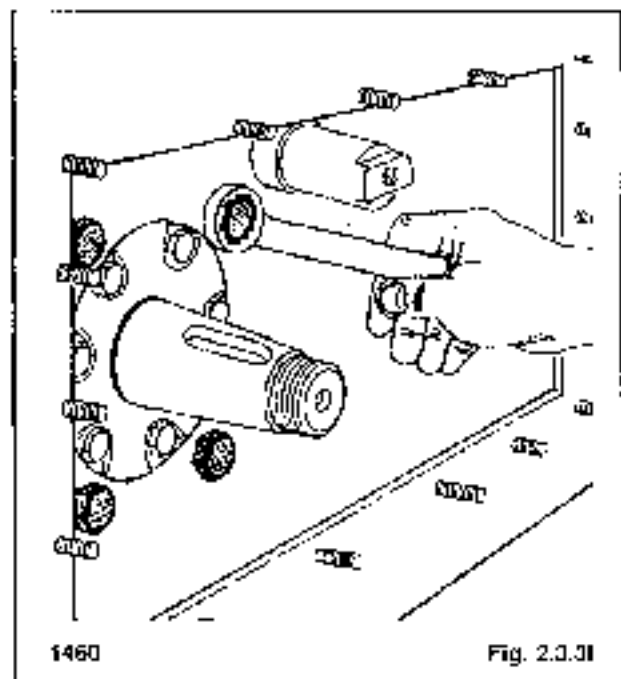
When making repairs to the hydrostatic system, keep all parts clean and remove dirt from the work area. Use caps and plugs on all lines and openings.



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Fig. 2.3.3k

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



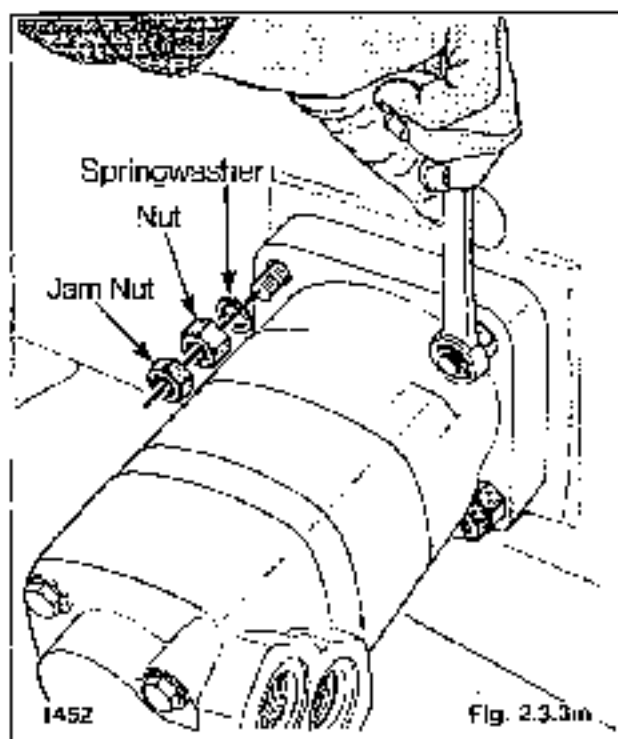
1460

Fig. 2.3.3l

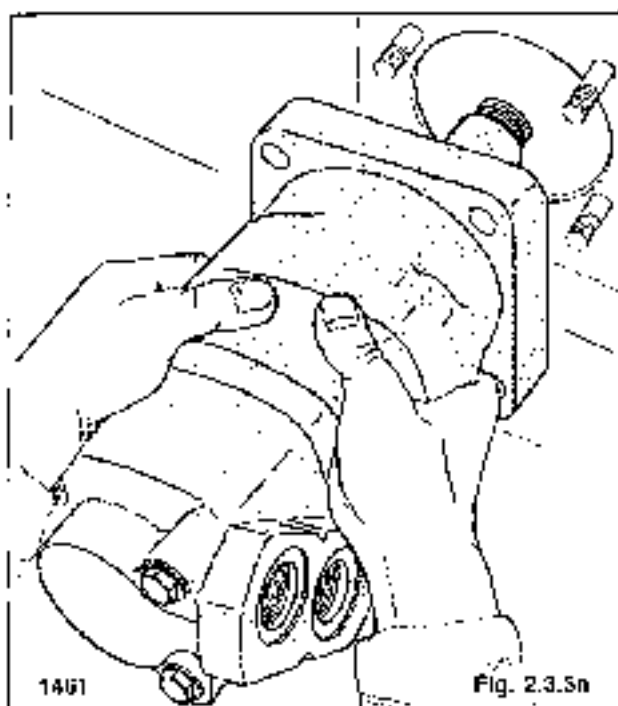
17. Remove the jam nuts, mounting nuts and lockwashers from the torque motor (fig. 2.3.3m).

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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.)

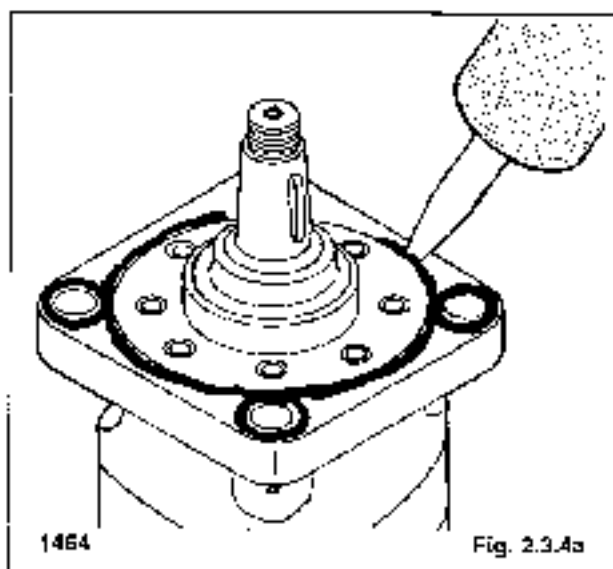


18 Remove the torque motor from the final drive housing (Fig. 2.3.3a)



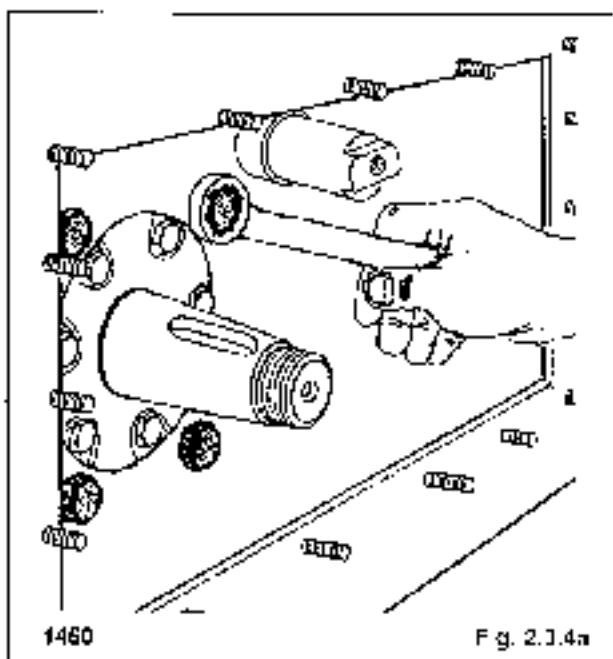
2.3.4 Torque Motor Replacement:

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

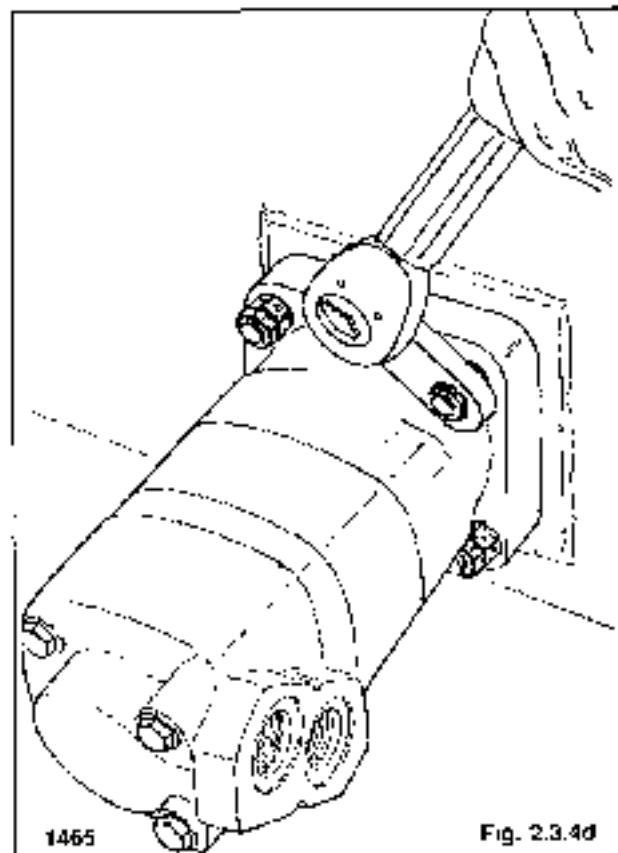
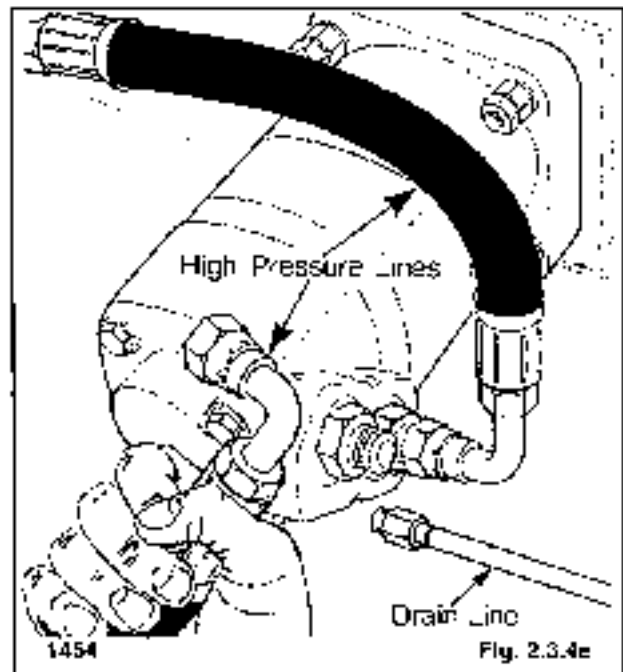
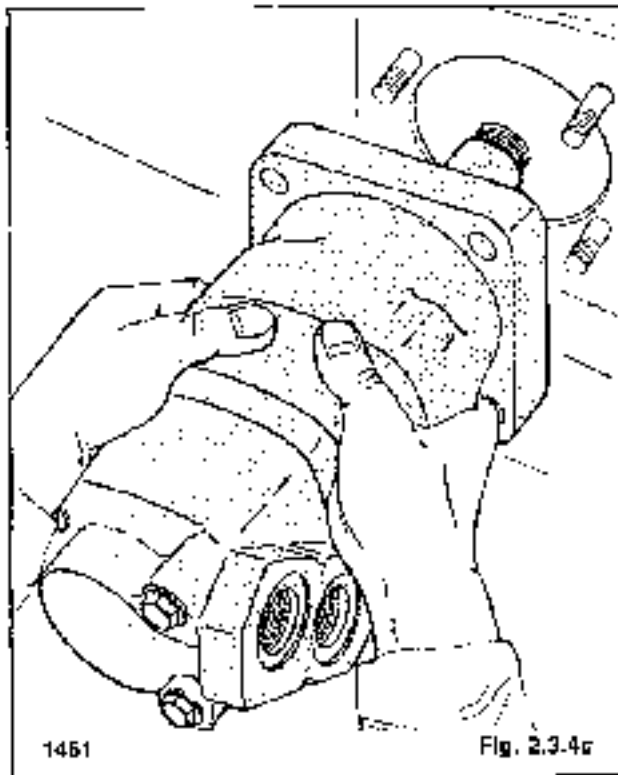


2. Install the torque motor mounting bolts from inside the final drive housing (Fig. 2.3.4b)

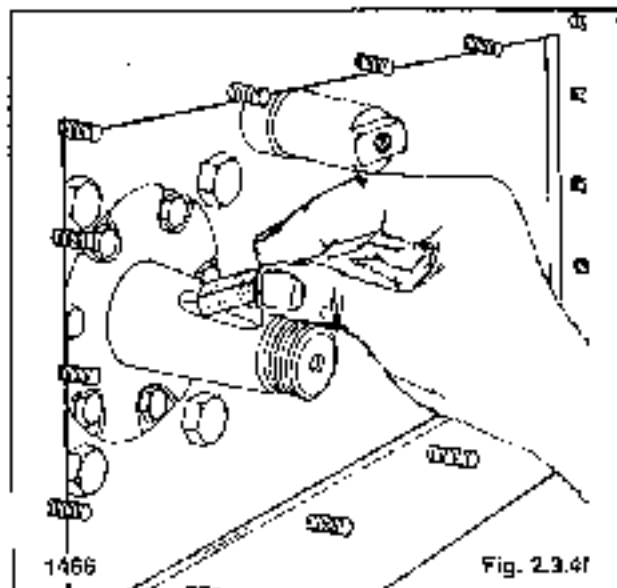
Hold the bolts in place with a wrench while the torque motor mounting nuts are being tightened.



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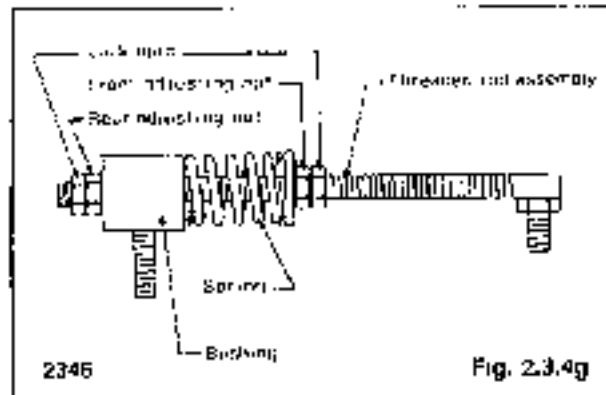


3. Install the torque motor in the first drive housing (Fig. 2.3.4c).
4. Install the lockwashers, mounting nuts and jam nuts which secure the motor to the housing (Fig. 2.3.4d).
Torque the mounting nuts 85-90 ft. lbs. (115-122 N.M.).
Torque the jam nuts 40-60 ft. lbs. (54-81 N.M.).
5. Install the torque motor drain line (Fig. 2.3.4e).
Install the two high pressure lines between the hydrostatic pump and torque motor (Fig. 2.3.4e).
6. Install the key on the torque motor shaft (Fig. 2.3.4f).

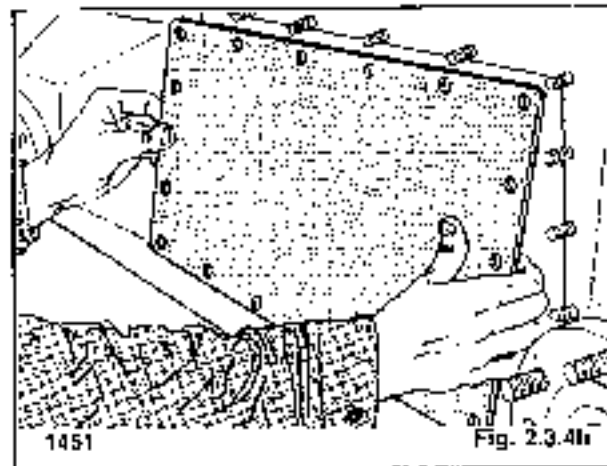


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7. Line up the sprocket with key and install the sprocket on the torque motor shaft.
8. Install the sprocket nut. Torque the nut to 350 ft. lbs (474.5 N.M.).
9. Install the brake disc, hex washers and stainless steel pin.
10. Bend both ends of pin to make a "Z".
11. Tighten brake caliper assembly, and reinstall threaded rod assembly (fig. 2.3.4g).



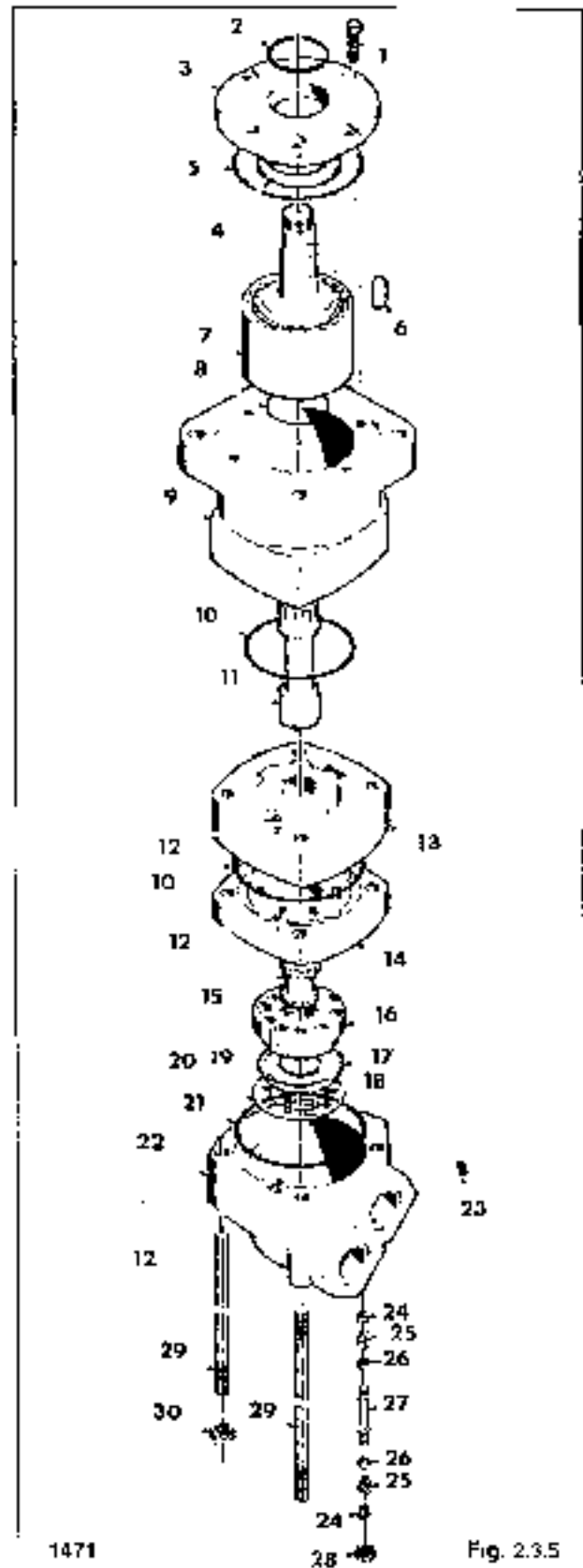
12. Fill the final drive housing to the correct level with 13W30 API SE/CD oil. Refer to section 3.1.5 for details. Capacity 3.5 gal. (14 L).
13. Apply sealant to the inspection cover and install the inspection cover on the final drive housing (fig. 2.3.4h).



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

IMPORTANT

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

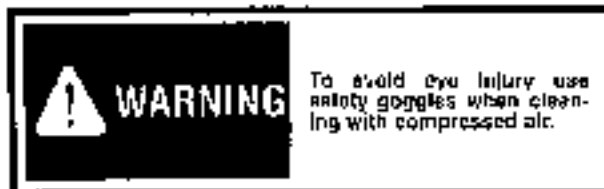


2 HYDROSTATIC DRIVE SYSTEM

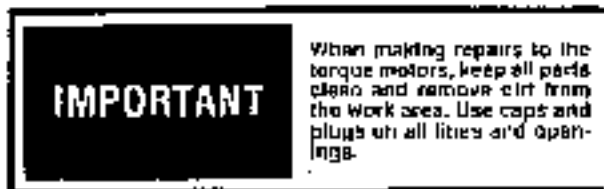
2.3.5 Torque Motor Disassembly

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



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



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.

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

1. Place the motor in a vice with the output shaft facing down (fig. 2.3.5a). Do not clamp the motor on the housing as excessive pressure will cause distortion.

Mark the body sections to assist in reassembly.

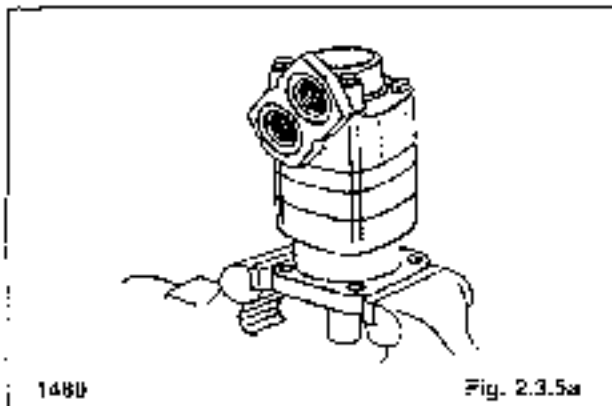


Fig. 2.3.5a

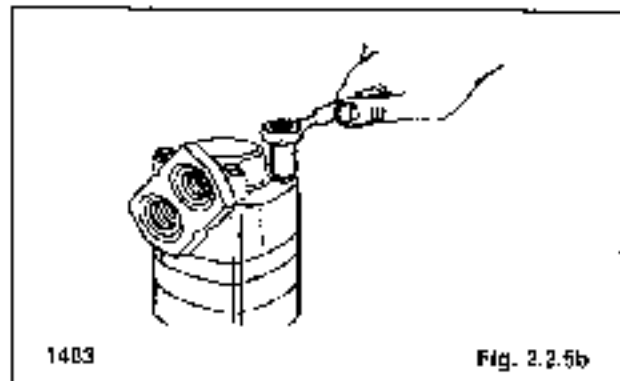


Fig. 2.3.5b

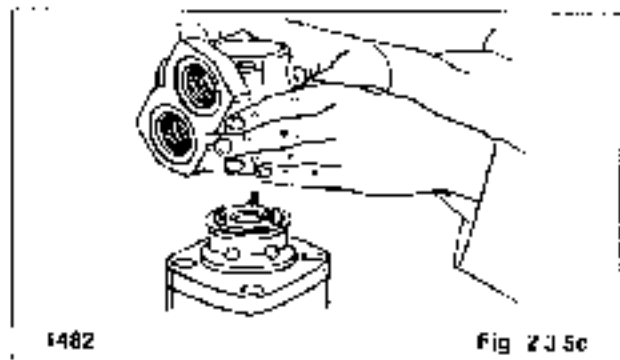


Fig. 2.3.5c

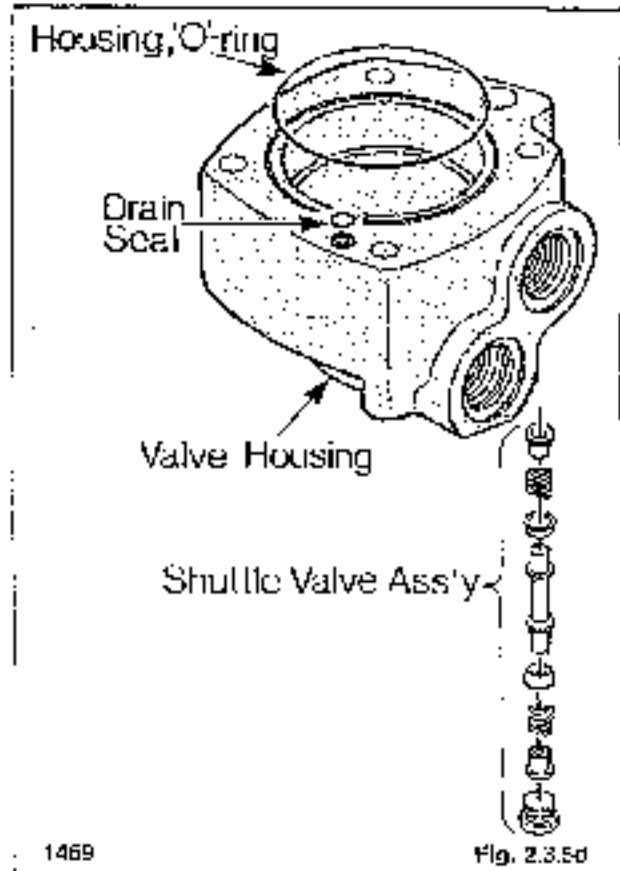
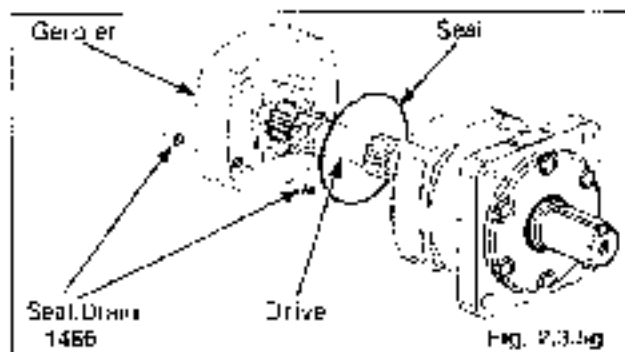
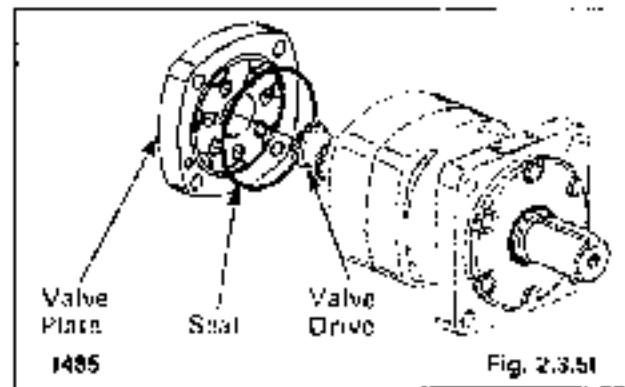
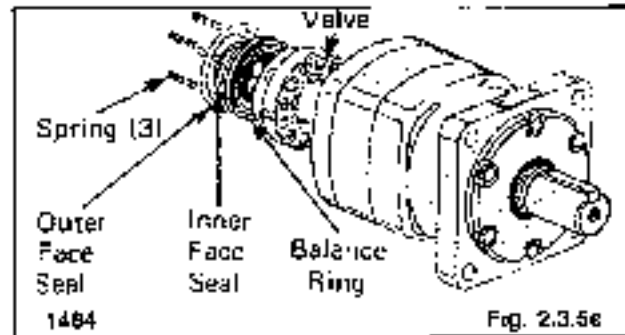


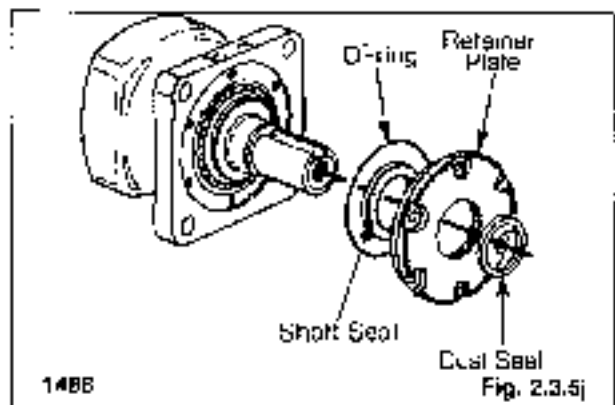
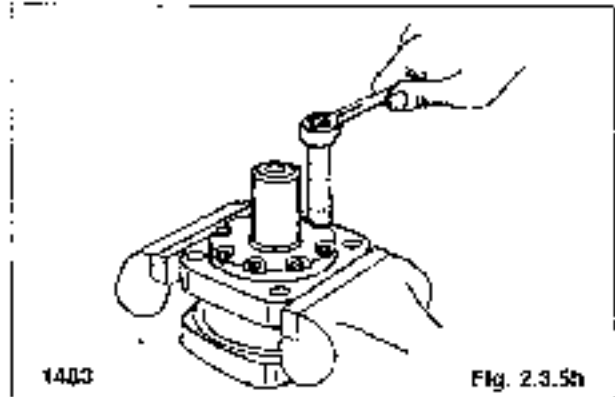
Fig. 2.3.5d

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2. Remove the four bolts from the motor valve housing (fig. 2.3.5a). On reassembly torque the mounting bolts to 62.5 ft. lbs. (84.7 N.M.). Follow the torque procedure outlined in section 2.3.7.
3. Carefully lift the valve housing straight up (fig. 2.3.5c). The balance ring subassembly and springs should remain on the valve.
4. Remove the following parts from the valve housing (fig. 2.3.5d).
 - 1 — housing seal
 - 1 — drain seal
 - 1 — shuttle valve assembly
5. Remove the three balance springs, balance ring and valve (fig. 2.3.5e). Remove both the inner and outer face seal from the balance ring.
6. Remove the valve plate, seal and valve drive (fig. 2.3.5f).



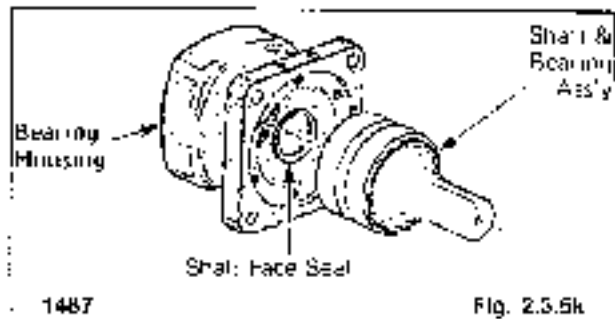
7. Remove the geroler assembly (fig. 2.3.5g). Keep the rollers and the inner geroler in the outer geroler ring.
8. Remove the two drain seals from each side of the geroler ring (fig. 2.3.5g).
9. Remove the geroler drive and the seal from the bearing housing (fig. 2.3.5g).



10. Turn the bearing housing over in the vice and remove the six retainer plate bolts (fig. 2.3.5h).

On reassembly torque the retainer plate bolts to 55 ft. lbs. (53.8 Bar). Follow the torque sequence as outlined in section 2.3.7.

11. Remove the retainer plate from the bearing housing (fig. 2.3.5i). The retainer plate may have to be pried free. Be careful not to damage the bearing housing or the retainer plate.



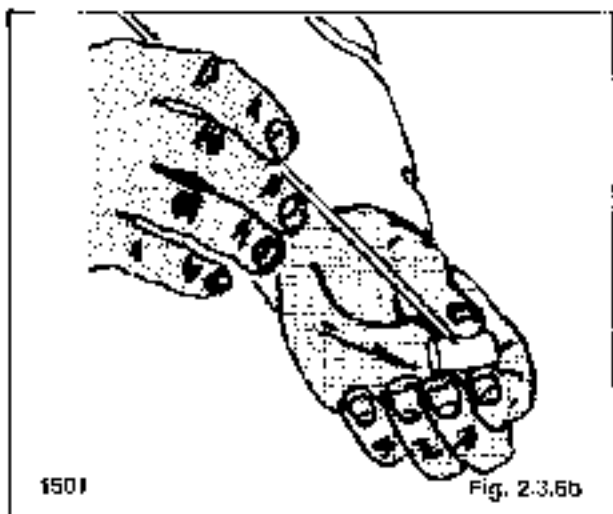
2 HYDROSTATIC DRIVE SYSTEM

12. Remove the dust seal, shaft seal and O-ring from the retainer plate (fig. 2.3.5j).

13. Remove the shaft and bearing assembly from the bearing housing (fig. 2.3.5k). The shaft may need to be pressed out.

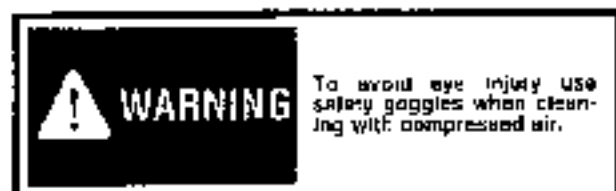
Remove the shaft face seal from the bore of the bearing housing (fig. 2.3.5k). Be careful not to damage the bore of the bearing housing.

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



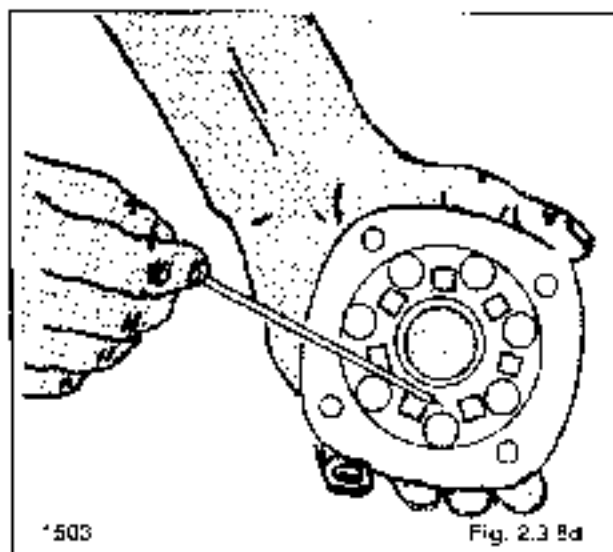
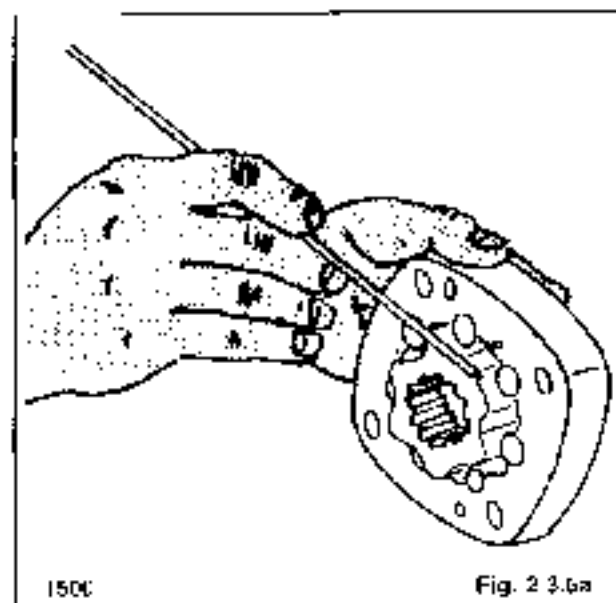
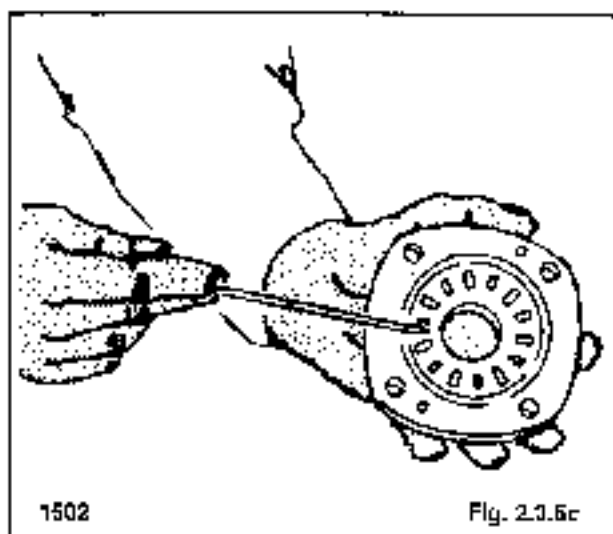
2.3.6 Torque Motor -- Inspection:

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

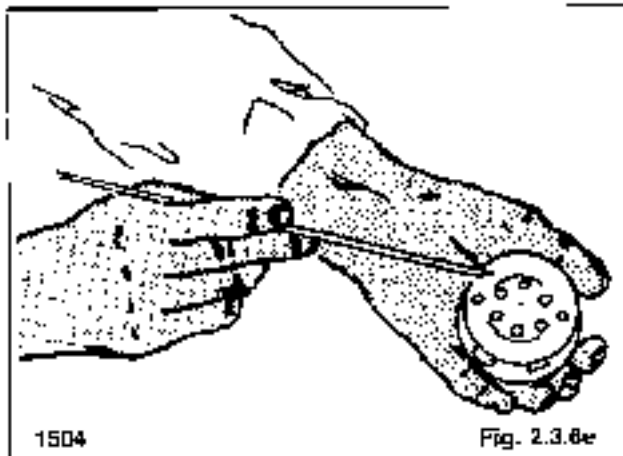


Do not use coarse grit or attempt to file or grind motor parts. Replace any parts that are scratched or have burrs that could cause damage.

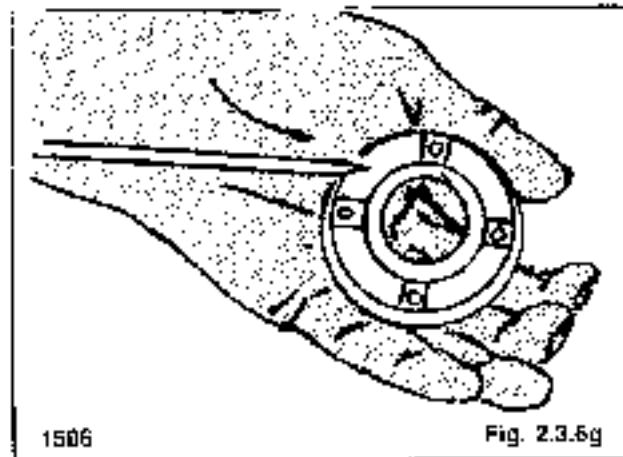
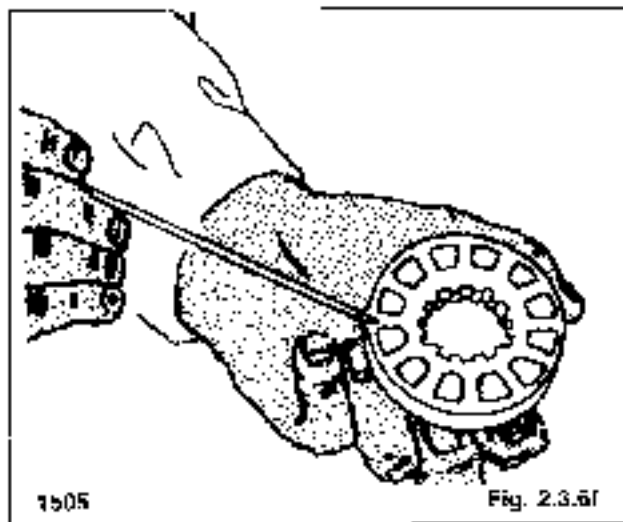
1. Inspect the governor star (fig. 2.3.6a) for wear or damage.



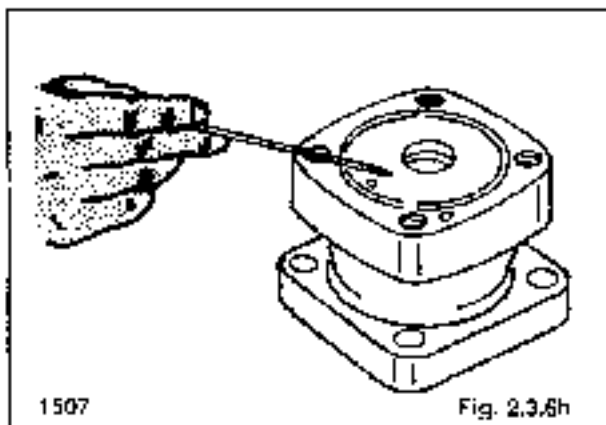
2 HYDROSTATIC DRIVE SYSTEM



2. Inspect the geroler rollers (fig. 2.3.6b) for wear or damage.
3. Inspect the valve bore (fig. 2.3.6c and fig. 2.3.6d) for scratches or wear.



4. Inspect the valve (fig. 2.3.6e and fig. 2.3.6f) for scratches or wear.
5. Inspect the balance plate for scratches or wear (fig. 2.3.6g).
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. 2.3.6h) for scratches or wear.



2.3.7 Torque Motor Reassembly

Install new seals when reassembling the torque motor.

Lubricate all seals with petroleum jelly such as vaseline 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.

Align the small I.D. end of the seal installation tube with the seal seat in the housing (fig. 2.3.7a).

Apply petroleum jelly to the shaft face seal.

Install the seal in the bore of the installation tube as shown in fig. 2.3.7a.

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

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

2 HYDROSTATIC DRIVE SYSTEM

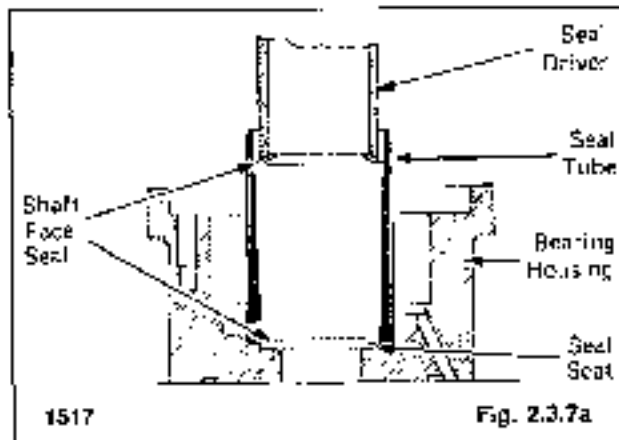


Fig. 2.3.7a

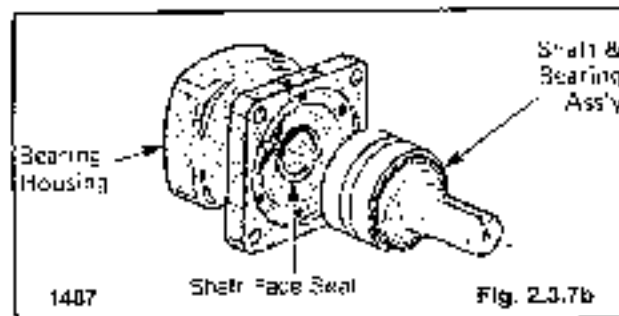


Fig. 2.3.7b

2. Install the shaft and bearing assembly in the housing (fig. 2.3.7b). A press may be required to install the shaft and bearing assembly.

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

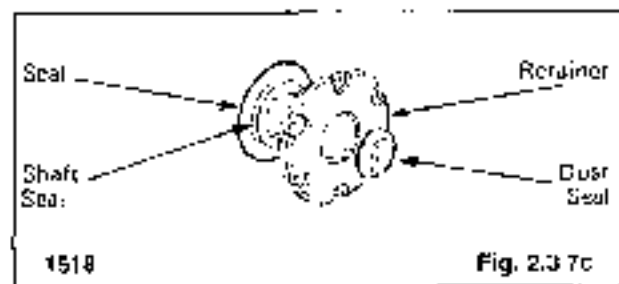


Fig. 2.3.7c

3. Install the dust seal in the retainer plate (fig. 2.3.7c). The metal side of the dust seal must face upward.
4. Install the retainer seal and the shaft seal (fig. 2.3.7c). The smooth or flat side of the shaft seal must face toward the retainer (fig. 2.3.7c).
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. 2.3.7e). Be careful not to distort or damage the shaft seal during assembly. Damage to the shaft seal will cause external leakage.

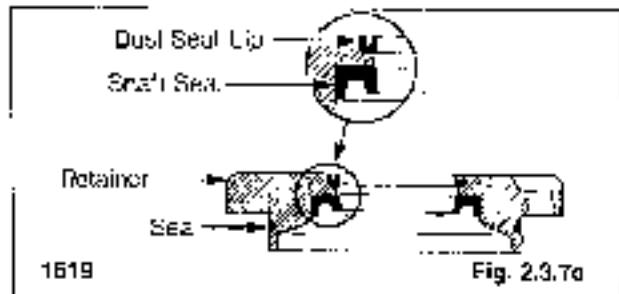


Fig. 2.3.7d

7. Lubricate the threads of the six retainer cover bolts and finger tighten all bolts. Torque the bolts in sequence (fig. 2.3.7f) 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 vice (fig. 2.3.7g) clamping across the edge of the flange.
9. Pour a small amount of system oil inside the output shaft.
10. If available, install two studs in the housing to assist in alignment of parts during assembly (fig. 2.3.7g).
11. Apply a light film of petroleum jelly to the housing seal and install the seal in the bearing housing (fig. 2.3.7e).

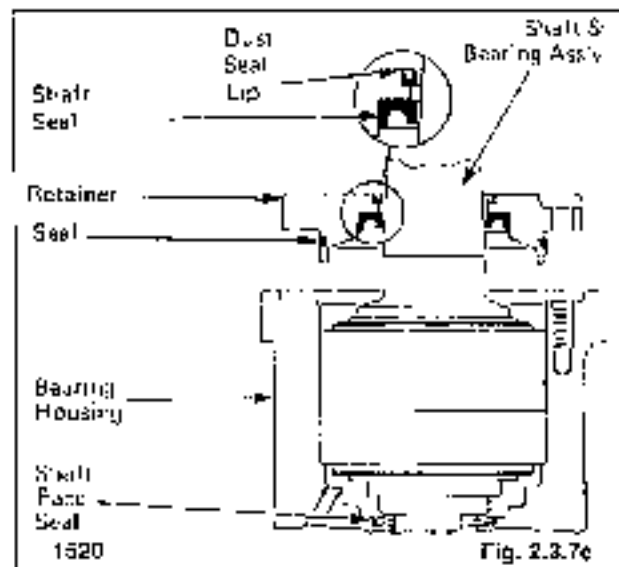


Fig. 2.3.7e

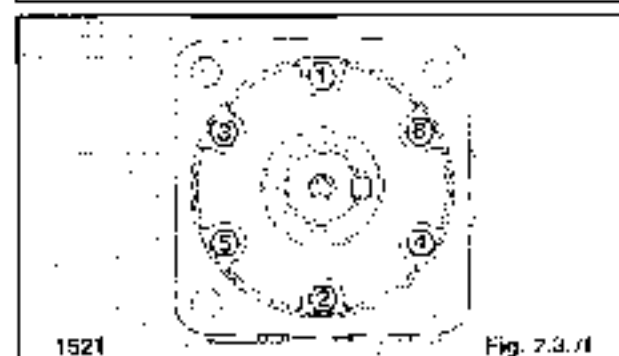
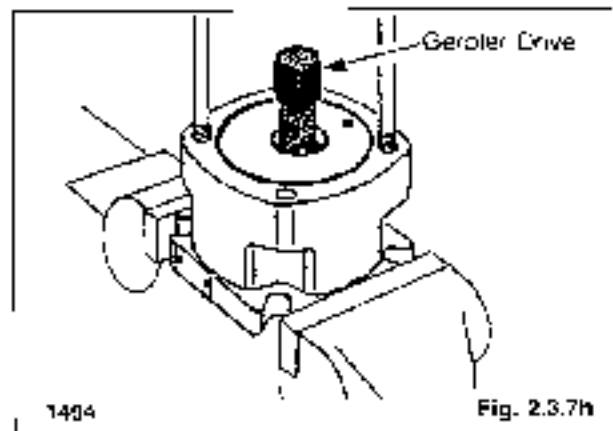
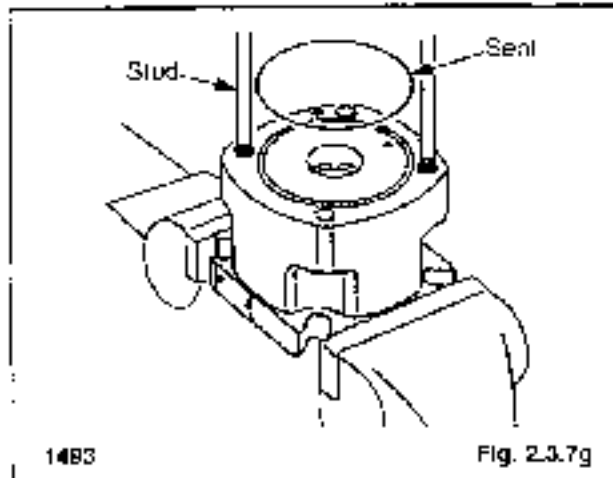
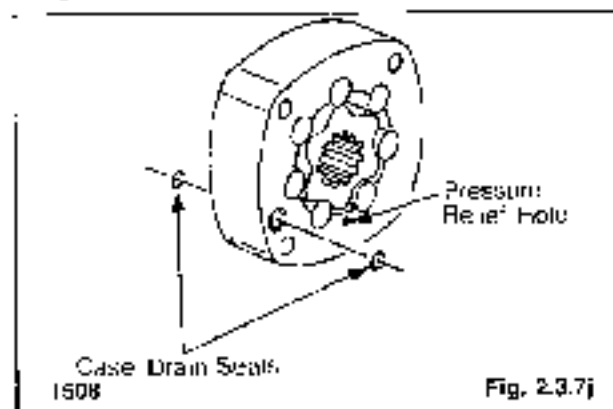


Fig. 2.3.7f

2 HYDROSTATIC DRIVE SYSTEM



12. Install the geroler drive in the bearing housing (fig. 2.3.7h). 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. 2.3.7j) in the case drain groove.
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. 2.3.7j). Install the geroler assembly on the bearing housing.



IMPORTANT

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

15. TIMING STEP NO. 1

Locate the largest open pocket in the geroler (fig. 2.3.7k). Mark the location of the pocket on the outside edge of the geroler.

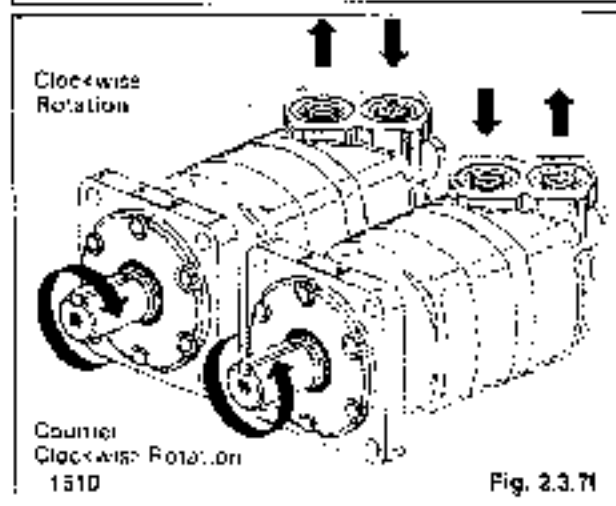
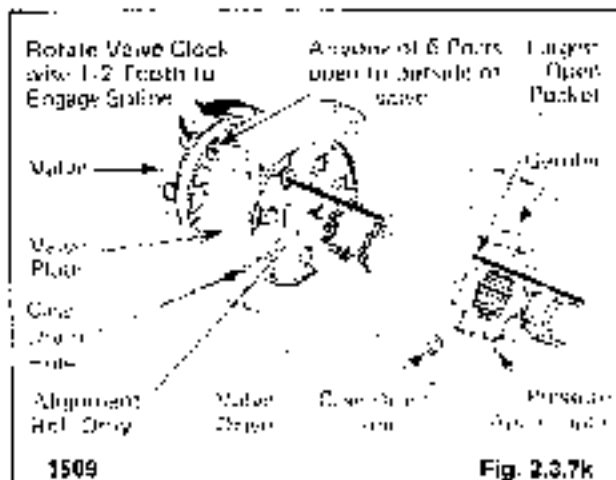
16. Install the valve drive in the geroler.

17. Apply a light film of petroleum jelly to 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. 2.3.7k).

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. 2.3.7k).



2 HYDROSTATIC DRIVE SYSTEM

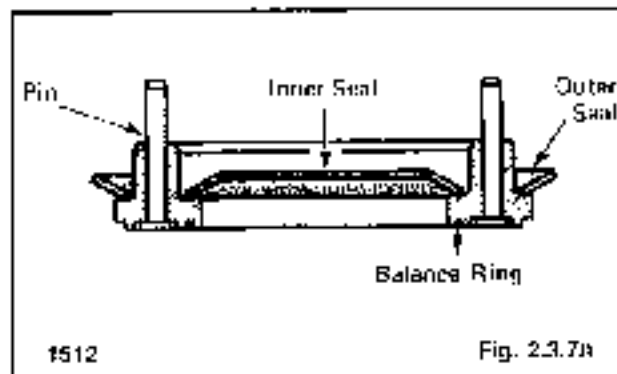
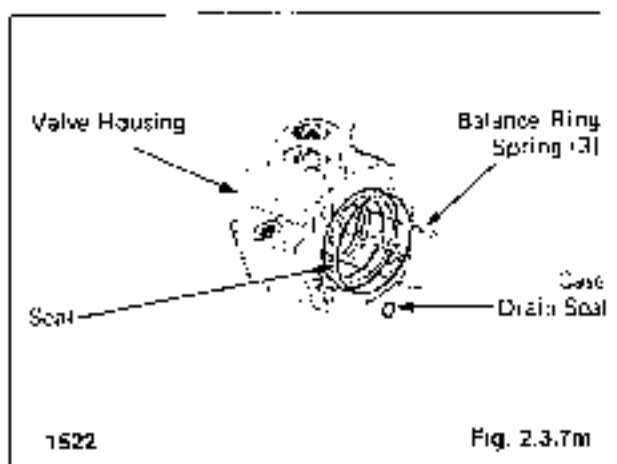
20. TIMING STEP NO. 3

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. 2.3.7k). Line up this side opening with the open slot of the valve plate that is in line with the largest open pocket of the governor.

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. 2.3.7l.

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. 2.3.7m).
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. 2.3.7n).
23. Apply a light film of petroleum jelly on the valve housing seal. Install the seal in groove on the valve housing (fig. 2.3.7m).
24. Apply petroleum jelly in both the outer and inner face seals. Install the face seals on the balance ring (fig. 2.3.7h).



IMPORTANT

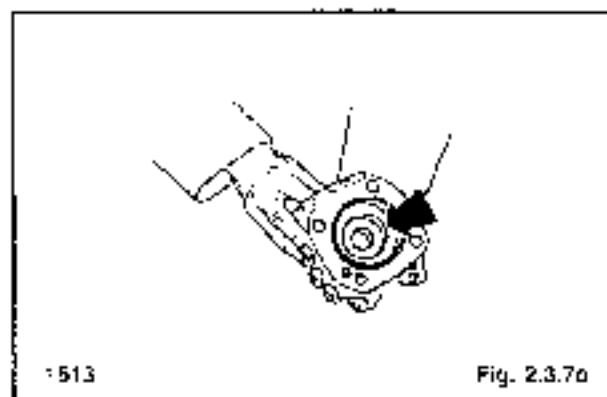
The face seals must be installed as shown on fig. 2.3.7h or the motor will not operate properly.

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. 2.3.7o). 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. 2.3.7p). Install the valve housing on the valve plate.

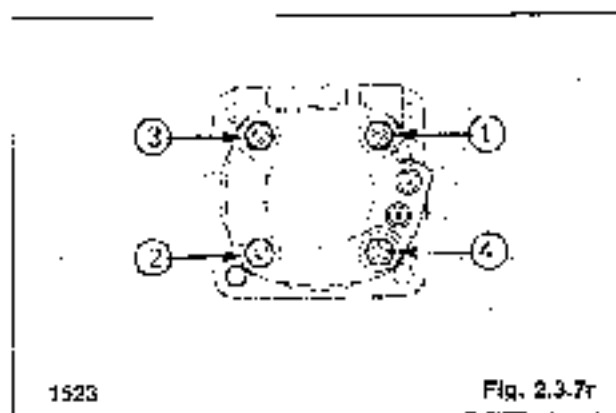
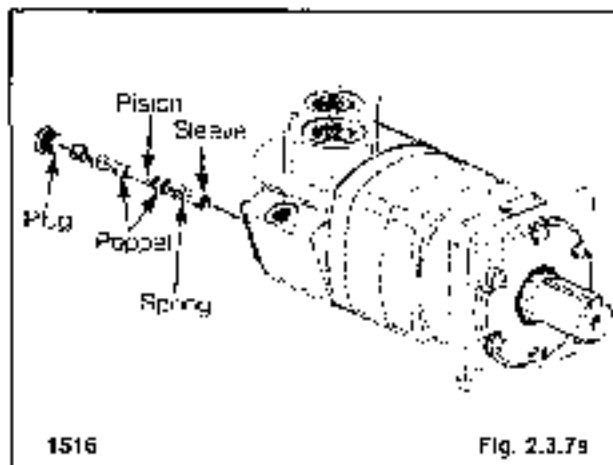
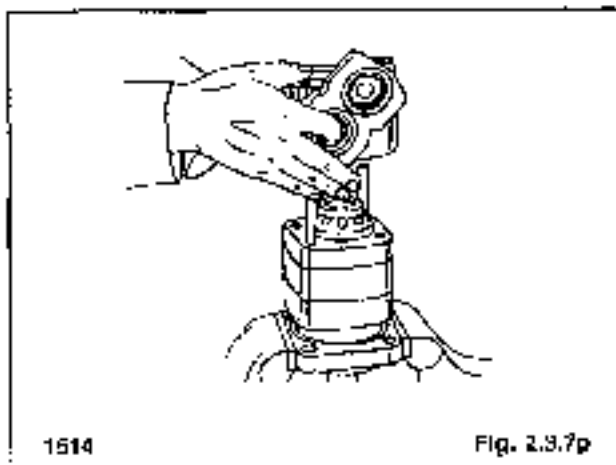
IMPORTANT

After installing the valve housing check between the body parts for disassembled seals.

28. Install and finger tighten the four bolts. Torque the bolts in sequence (fig. 2.3.7r) to 62.0 lbf. lbs. (84.7 N.M.).
29. Install the shuttle valve assembly in the valve housing (fig. 2.3.7s).



2 HYDROSTATIC DRIVE SYSTEM



IMPORTANT

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

2 HYDROSTATIC DRIVE SYSTEM

2.4 Trouble Shooting — Hydrostatic Drive System:

Problem	Cause	Corrective Action	Refer to Section
Loss of drive power on one side — both directions	Reservoir low on oil	Check for leaks. Fill the reservoir with 10W30 API SE-CC oil.	1.0.3
	Disconnected steering control linkage	Reconnect and adjust steering control linkage.	4.1
	Groove pin sheared on pump pinile lever	Replace. Check pinile 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
	Drive motor shaft failure	Inspect and repair defective parts. Check motor mounting bolts.	2.3.5
	Charge pump failure	Inspect and repair defective parts. Drive may initially appear to be lost on one side only but after a few moments running will be lost on both sides.	2.2.8
	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.	2.2.7 2.3.5
Loss of drive power on one side — one direction only	Defective pump relief valve	Replace defective relief valve.	2.2.5
	Damaged pump ball check	Disassemble pump and repair.	2.2.6
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-CC oil.	1.0.3

2 HYDROSTATIC DRIVE SYSTEM

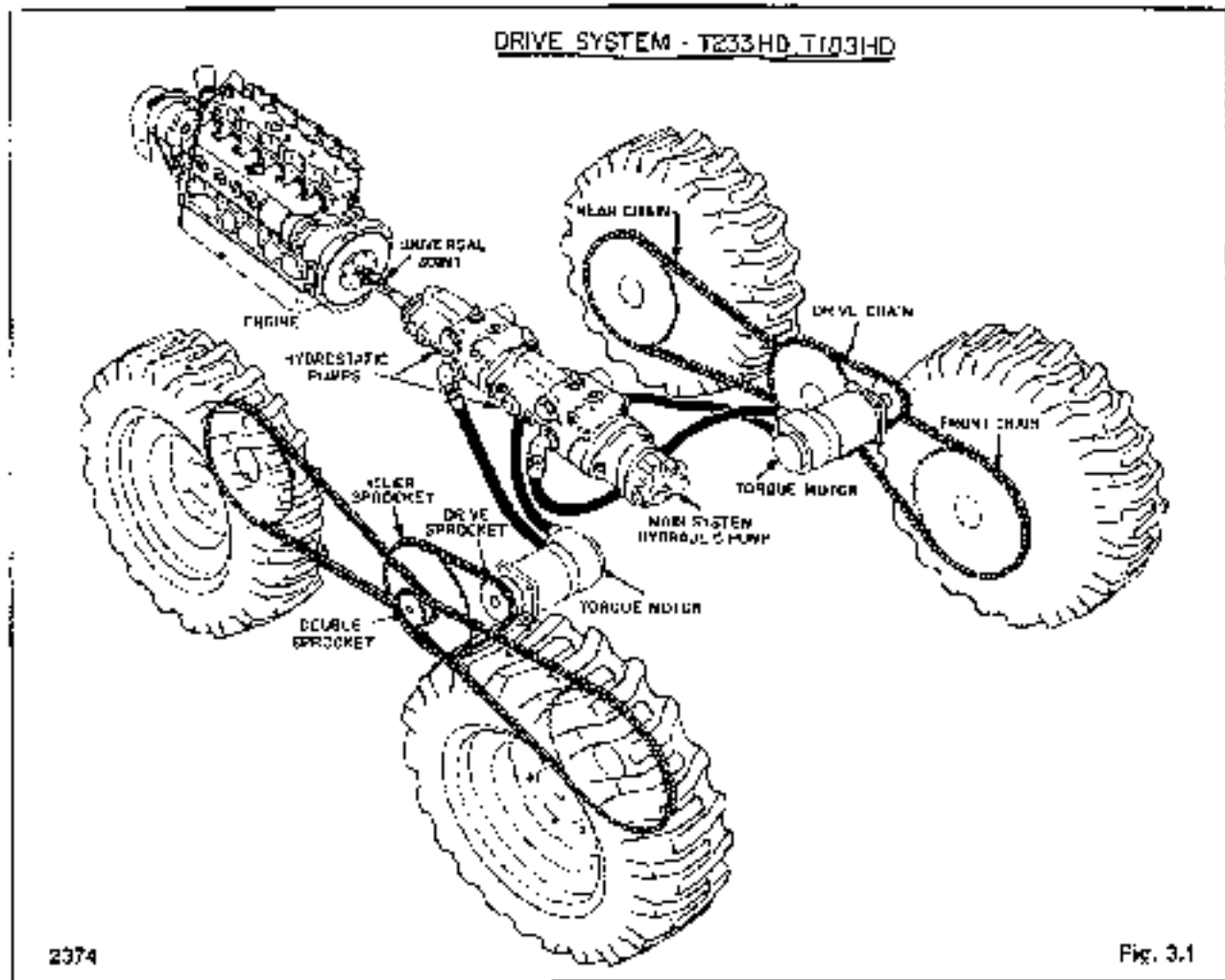
Loss of drive power — both sides (full hydraulic power)	Universal joint between engine and pump failure	Inspect and repair or replace damaged parts.	
	Drive coupling failure between front and rear pump	Inspect coupling and shafts for spine damage. Also check pump bearings	2.2.6
	Charge pump shaft failure	Inspect and replace damaged parts.	2.2.6
	Charge pump failure	Inspect and replace damaged parts.	2.2.8
	Charge pump relief valve failure	Inspect and replace damaged parts.	2.2.6
	Excessive internal leakage or damage in pumps and/or motors	Inspect and repair defective parts	2.2.6 2.3.5
Gradual loss of power as the machine warms up	Excessive internal leakage in pumps or motors	Inspect and repair defective parts	2.2.6 2.3.5
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
	Drive chain out of adjustment	Adjust	3
Tractor will not travel in a straight line	Control levers binding	Check that shields or speed insulation prevents full lever travel. Repair	
		Check self centering spring for binding. Adjust.	4
	Control lever travel stops out of adjustment	Adjust.	4

SECTION 3 FINAL DRIVE

FINAL DRIVE	3.1
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Lubricating oil — draining	3.1.4
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3 FINAL DRIVE

3.1 FINAL DRIVE



3.1.1 Specifications:

	T163HD	T233HD
Chain size — primary	ASA 80	ASA 80
front axle ..	ASA 100	ASA 100
rear axle	ASA 100	ASA 100
Lubricating oil	10W30 AP SE, CD	
Capacity (per housing)	3.5 gal. (14 l)	3.5 gal. (14 l)
Approved chain manuf.	TSUBAKI	
Torque specifications		
Hydrostatic motor mtg. bolts	80-85 lbs. ft. (109-116 N.M.)	
Idler flange nuts	40-45 lbs. ft. (54-61 N.M.)	
Wheel nuts	100-110 lbs. ft. (136-148 N.M.)	
Drive housing mtg. bolts	70 lbs. ft. (95 N.M.)	
Tire pressure —		
10.00 x 16.5	30-35 PSI (207-241 kPa)	
12.00 x 16.5	30-35 PSI (207-241 kPa)	

3.1.2 Maintenance Schedule:

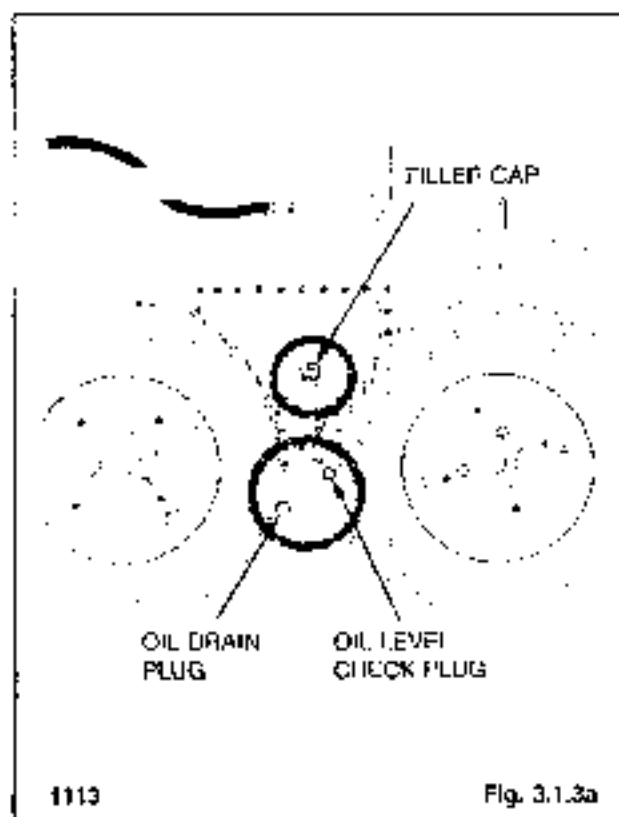
	Initial check (hours)	Check every (hours)
Tire pressure	5	5
Wheel nut torque	3	5
Lubricating oil	50	150 (1)
Chain tension	50	150
Axle bearing preload	50	150
Motor mtg. bolts	50	150
Idler flange nuts	50	150
Drive housing mtg. bolts	50	150

(1) Change every 1000 hours

3 FINAL DRIVE

3.1.3 Lubricating Oil — Level Check:

The loader has two independent final drive housings. Check the lubricating oil level with the loader on a level surface. Remove the check plug (fig. 3.1.3a) located between the two tires to determine the oil level. The oil level should be checked after 50 operating hours and every 150 hours thereafter. It is recommended the oil be changed after 1000 operating hours or if it shows signs of contamination.



3.1.4 Lubricating Oil — Draining:

To drain the final drive lubricating oil place the loader on a level surface. Remove the oil drain plug (fig. 3.1.3a) located between the two tires.

Total capacity per final drive housing
T183HD . . . 3.5 Gal. (14 L)
T233HD . . . 3.5 Gal. (14 L)

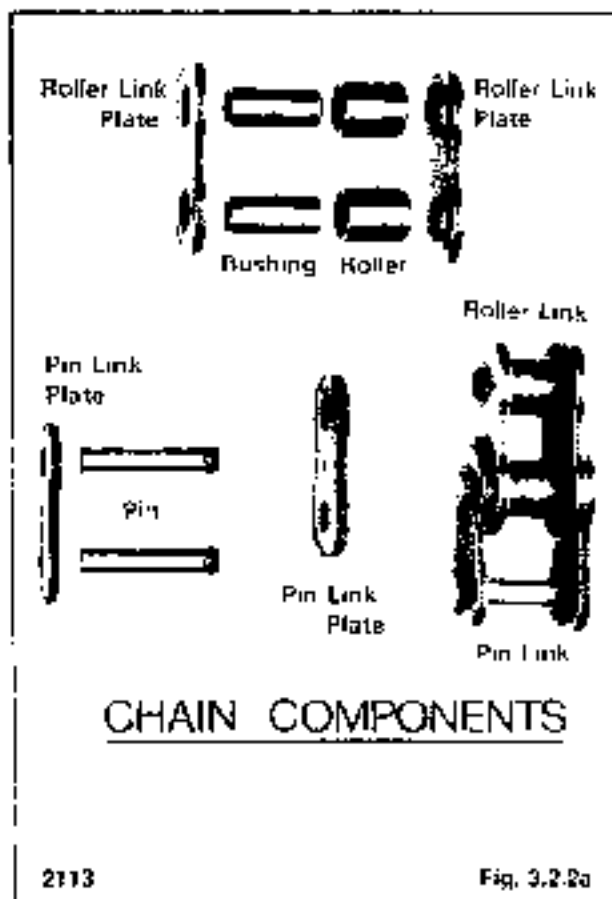
3.1.5 Lubricating Oil — Adding:

Add oil with the loader on level ground. Remove the oil level check plug (fig. 3.1.3a) on the final drive housing. Remove the tiller cap. Fill with 10W30 API Classification SAE-CD engine oil up to the oil check plug level. Total capacity is 3.5 gal (14 L) on the T183HD and 3.5 gal (14 L) on the T233HD.

3.2 DRIVE CHAIN

3.2.1 Chain Inspection:

The drive chains should be inspected for wear or damage after the first 50 hours of operation and every 150 hours thereafter or at any time the final drive inspection cover is removed. If the chain shows any sign of wear or damage replace it. Inspect as follows (fig. 3.2.2a).



1. Inspect the chain for excessive roller wear.
2. Inspect the chain for excessive wear on the link plates.
3. Inspect the pins for signs of wear caused by interference.
4. Inspect the connection link cotter pins for wear or damage caused by interference.
5. Check the sprockets for excessive wear or damage.
6. If the chain has been removed from the loader check for stiffness caused by wear between the pins and bushings.
7. If the chain is removed from the loader check that when laid out it runs straight and not to one side indicating misalignment.

3 FINAL DRIVE

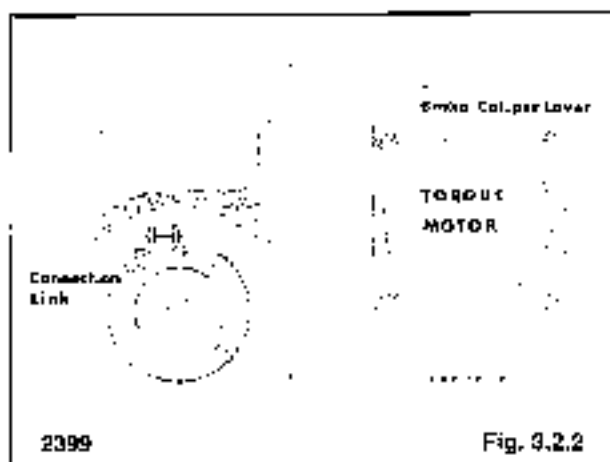
3.2.2 Primary Chain — Replacement:

REMOVAL:

1. Block the loader securely with the wheels clear of the ground.
2. Remove the wheels. On reassembly torque the wheel nuts 100-110 lbs. ft. (136-149 N.M.).
3. Remove the inspection cover and cover plate from the final drive housing.

On reassembly apply silicone sealer to the inspection cover to prevent leakage.

4. With the throttle control lever in the off position and the steering control lever in full forward position, turn the engine over with the starter motor revolving the chain until the primary chain connection link is visible (Fig. 3.2.2).



5. Remove brake lever/rod assembly from brake-caliper lever.

See Section 4.5 for replacement and adjustment.

6. Loosen the brake-caliper assembly.
7. Remove 2" pin from end of torque motor shaft.
8. Remove the 3 flex washers and brake disc.
9. Disconnect the connection link and remove the primary chain.

On reassembly use a new connection link and cotter pins.

REPLACEMENT:

1. Using a piece of wire attached to the chain as a guide, install the primary chain around the idler sprocket.
2. Install the chain around the drive sprocket.
3. Install a new connection link with the cotter pins on the back side of the chain.
4. Replace brake disc.

See Section 4.5 for brake replacement and adjustment.

3.2.3 Front Axle Chain — Replacement:

REMOVAL:

1. By turning the axle, revolve the chain until the connection link is visible.
2. Remove the connection link and front axle chain from the final drive housing.

On reassembly install a new connector link and cotter pins.

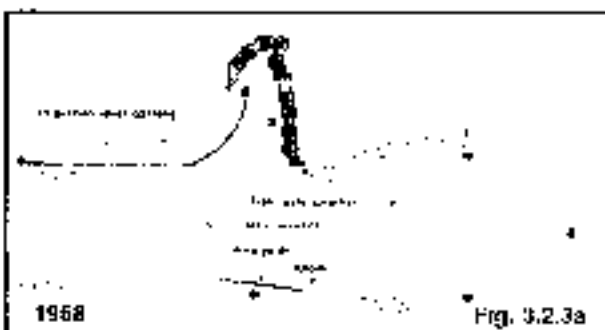
REPLACEMENT:

1. Using a piece of wire attached to the chain as a guide, 'load' the front axle chain over the top of the axle sprocket and under the idler sprocket (Fig. 3.2.3a).

NOTE: The front chain must be installed to the front side of the final drive housing towards the inspection cover.

2. Install a new connection link and cotter pins.

Install the connection link with the cotter pins facing the outside or inspection cover side of the chain.



3.2.4 Rear Axle Chain — Replacement:

REMOVAL:

1. By turning the axle, revolve the chain until the connection link is visible.

3 FINAL DRIVE

2. Remove the connection link and the rear axle chain from the final drive housing.

On reassembly install a new connection link and cotter pins.

REPLACEMENT:

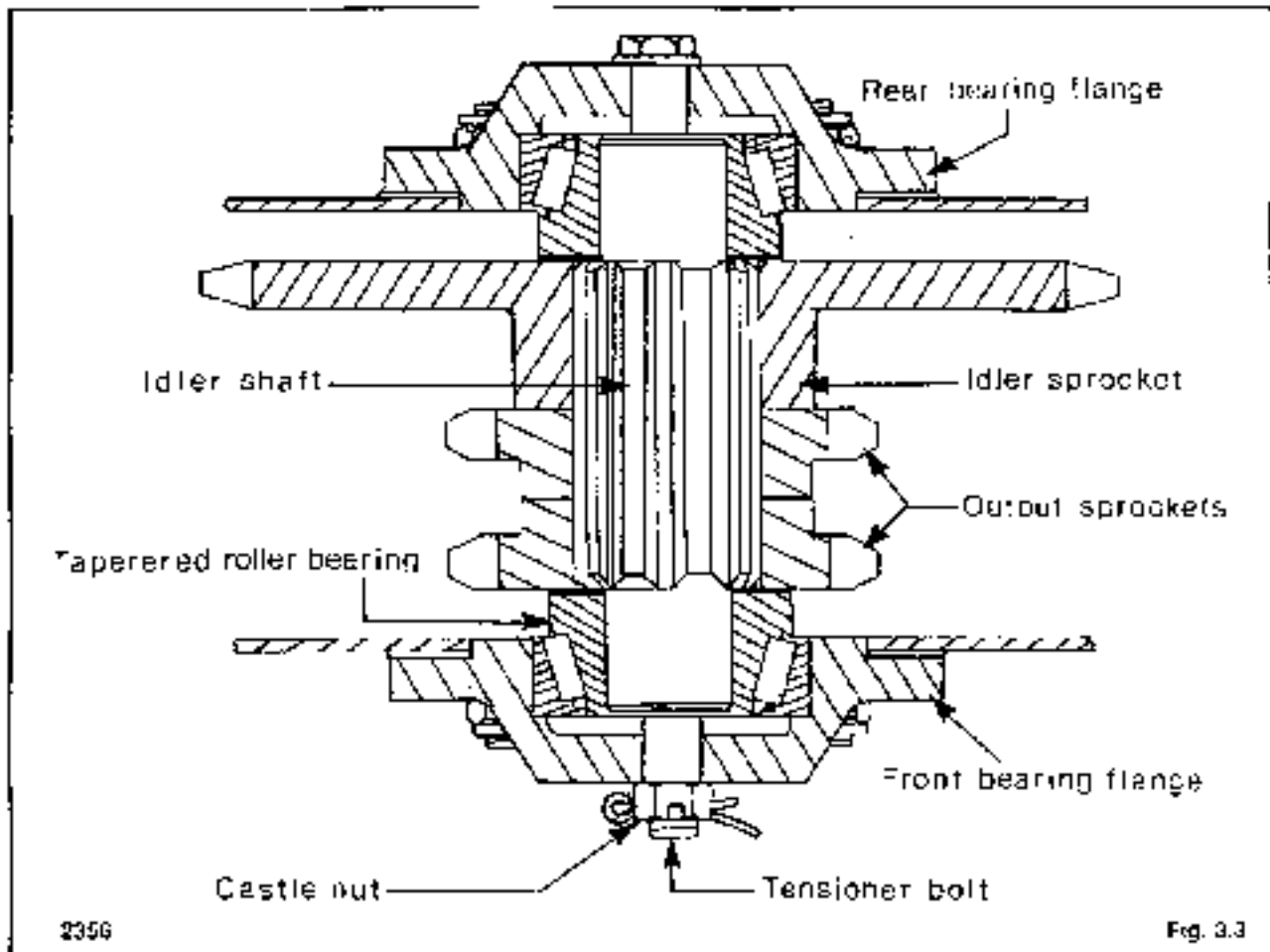
1. Using a piece of wire attached to the chain as a guide, lead the chain over the top of the rear axle sprocket and under the idler sprocket (fig. 3.2.4a).



NOTE: The rear chain must be mounted on the center idler sprocket between the front and primary sprockets.

2. Install a new connection link and cotter pins. Install the connector link so the cotter pins are on the backside of the chain.

3.3 IDLER SPROCKET AND SHAFT



3 FINAL DRIVE

3.3.1 Bearing Preload Adjustment:

1. Block the loader securely with the wheels clear of the ground.
2. Remove the wheels. On reassembly torque the wheel nuts 100-110 lbs. ft. (126-149 N.M.).
3. Remove the final drive coverplate located between the two axles.

On reassembly apply silicon sealer to the inspection cover to prevent leakage.

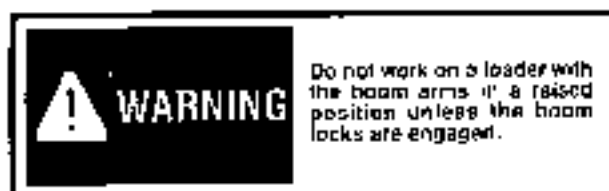
4. Rock the idler sprocket to determine if there is any play in the idler shaft (fig. 3.3).
5. If play is detected, remove the cotter pin from the castle nut on the end of the tensioner bolt (fig. 3.3).
6. Place a screwdriver in the slot on the end of the tensioner bolt (fig. 3.3) and tighten the castle nut until there is no play in the idler sprocket shaft.

CAUTION: The idler sprocket will slide back and forth approximately a 1/8th of an inch on the idler shaft and should not be confused with idler shaft play.

7. Install a new cotter pin on the castle nut.

3.3.2 Idler Sprocket & Shaft — Removal:

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



2. Block the loader securely with the wheels clear of the ground.
3. Remove the wheels. On reassembly torque the wheel nuts 100-110 lbs. ft. (126-149 N.M.).
4. Remove the final drive coverplate located between the two axles.

On reassembly apply silicon sealer to the inspection cover to prevent leakage.

5. Drain the lubricating oil from the final drive housing (see 3.1.4).
6. Remove the primary chain (refer to section 3.2.3).

7. Remove the cotter pin, castle nut and tensioner bolt (fig. 3.3.2a).

8. Remove the front and rear flanges from the housing (fig. 3.3.2a).

9. Using a brass drill, drive the splined output shaft through the idler sprocket and double axle sprocket.

Remove the splined shaft as it is driven out the back side of the final drive housing (fig. 3.3.2b).

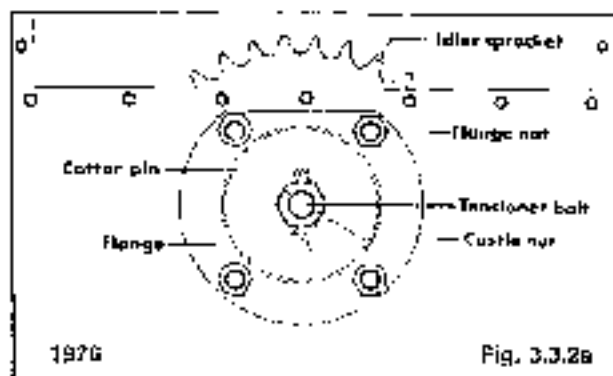


Fig. 3.3.2a

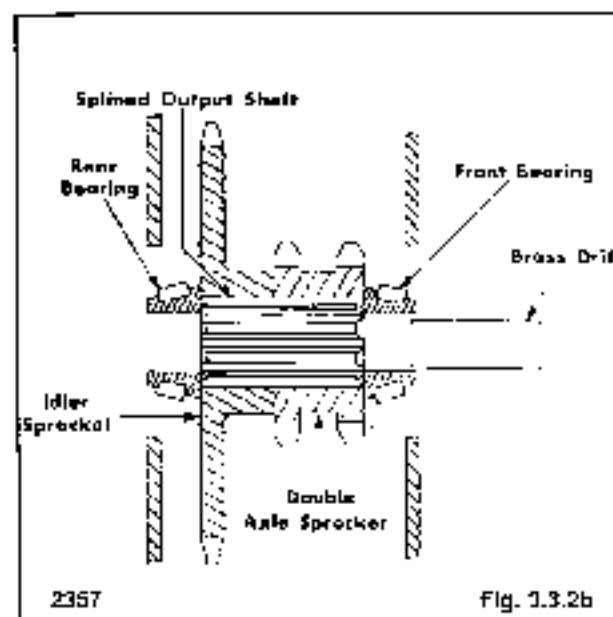
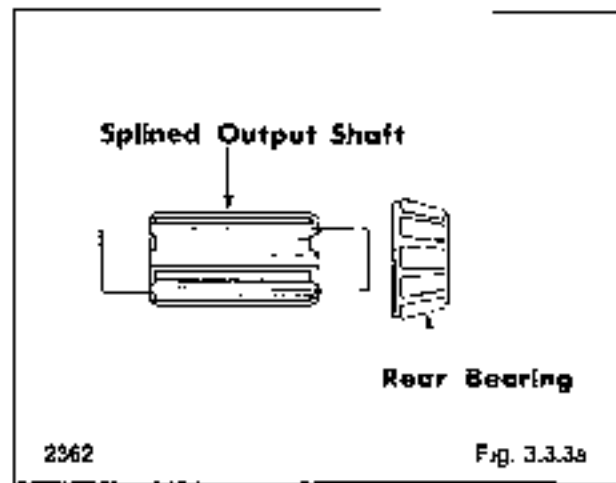
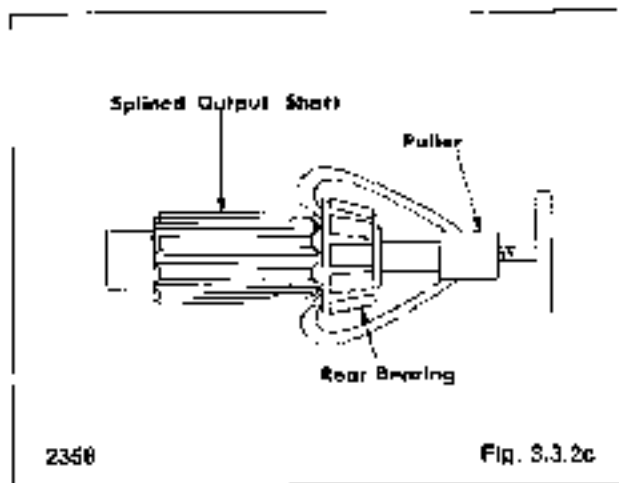


Fig. 3.3.2b

NOTE: The rear bearing will remain with the splined output sprocket during removal.

10. Disconnect the front and rear axle drive chains, remove the double axle sprocket and front bearing from the final drive housing.
11. Remove the idler sprocket from the final drive housing.
12. Using a proper puller, remove the rear bearing from the splined output shaft (fig. 3.3.2c).

3 FINAL DRIVE



3.3.3 Idler Sprocket & Shaft — Installation:

- 1 Using a suitable driver install the rear bearing on bearing surface of the splined output shaft (fig. 3.3.3a).
- 2 Lubricate the parts and mount the double axle sprocket and idler sprocket on the splined shaft (fig. 3.3.3b).
- 3 Install the rear flange and torque the mounting nuts 45-55 lbs. ft. (61-75 N.M.) (fig. 3.3.3b)

Apply silicon sealant to the rear flange to prevent leakage.

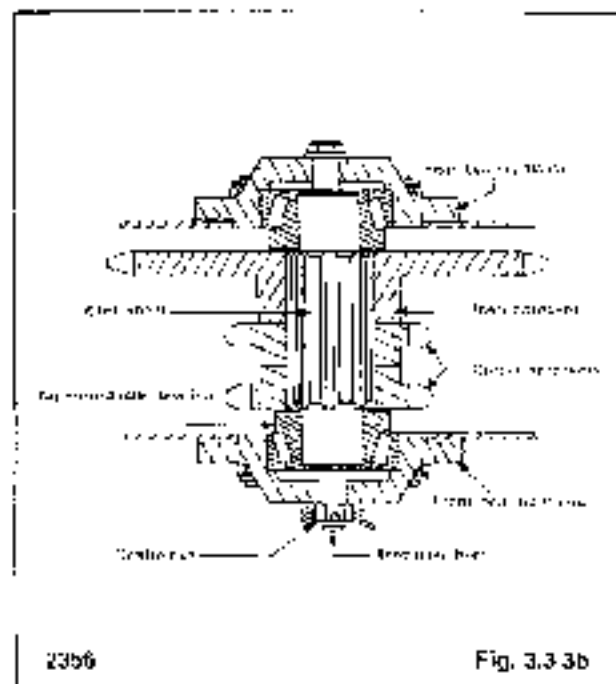
Install new nylok nuts on the flange during reassembly.

- 4 Using a suitable driver install the front bearing on the splined shaft.
5. Install the front flange on the final drive housing.

Apply silicon sealant to the flange to prevent leakage.

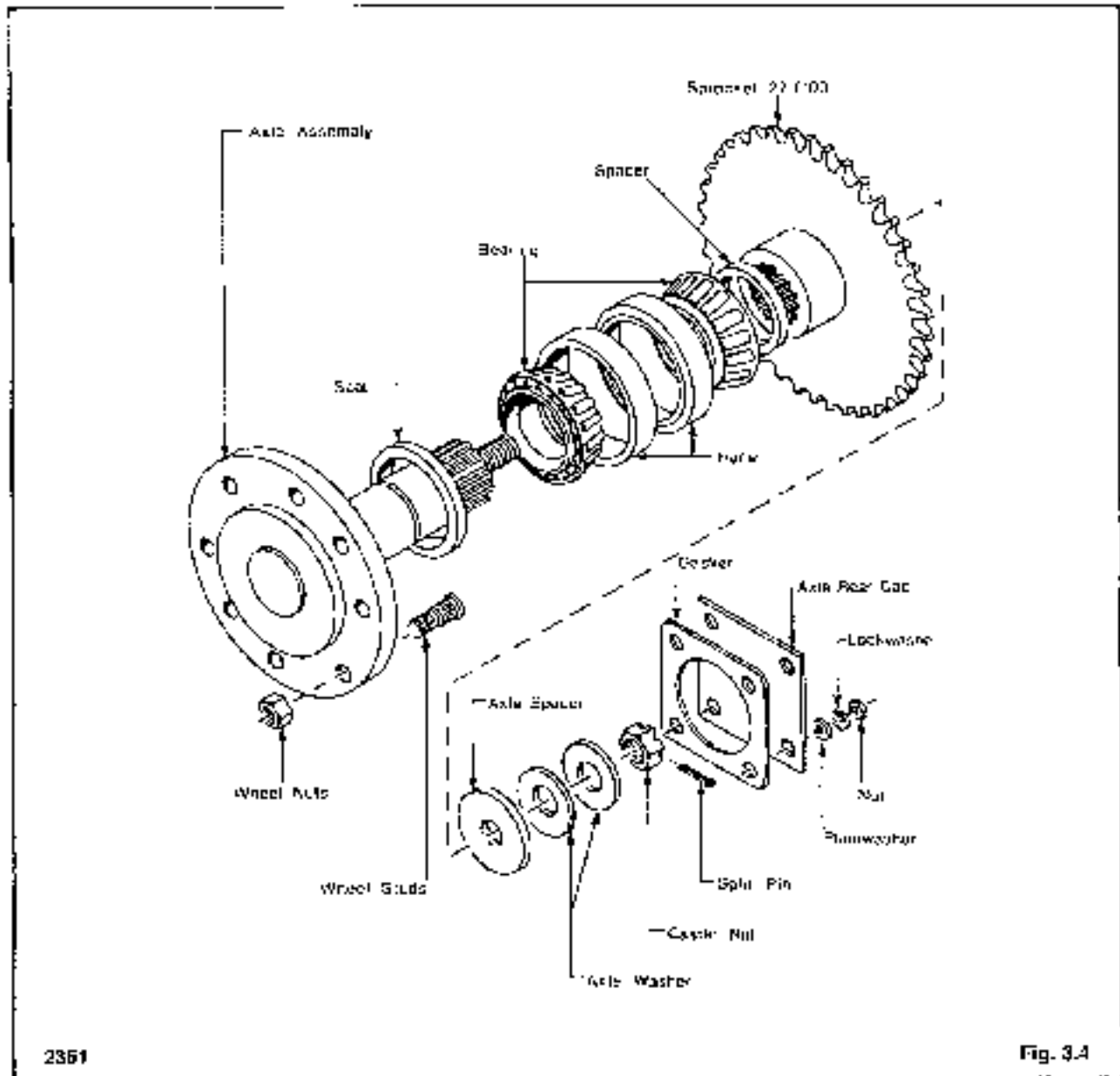
Install new nylok nuts to the flange studs. Start but do not tighten the flange nuts until the axle drive chains are connected.

6. Reconnect the axle drive chain on the double axle sprocket (refer to 3.2.4 and 3.2.5).
7. Reconnect the primary chain (refer to 3.2.3)
- 8 Torque the flange nuts 45-55 lbs. ft. (61-75 N.M.).
- 9 Install the tensioner bolt and castle nut and preload the bearing to remove all end play (refer to 3.3.1).
- 10 Install a new cotter pin on the castle nut.
- 11 Refill the final drive housing with lubricating oil (refer to 3.1.5) and reinstall the coverplate.
12. Apply silicon sealant to the coverplate to prevent leakage.



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3.4 AXLE ASSEMBLY



3.4.1 Axle Removal:

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



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.

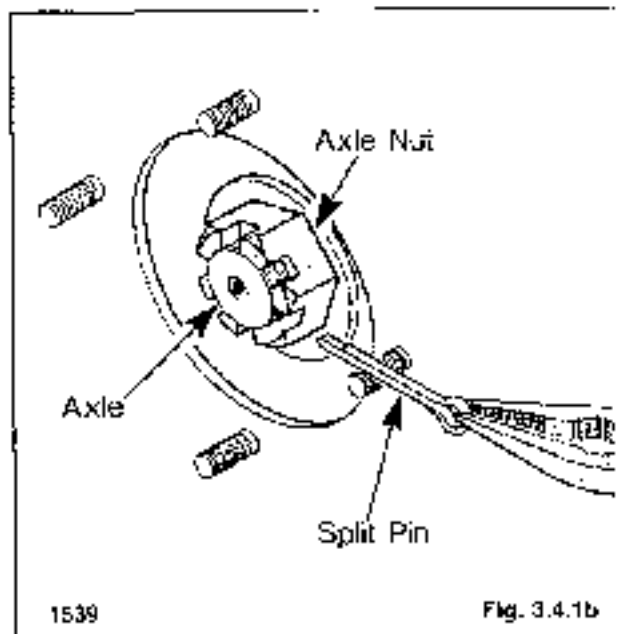
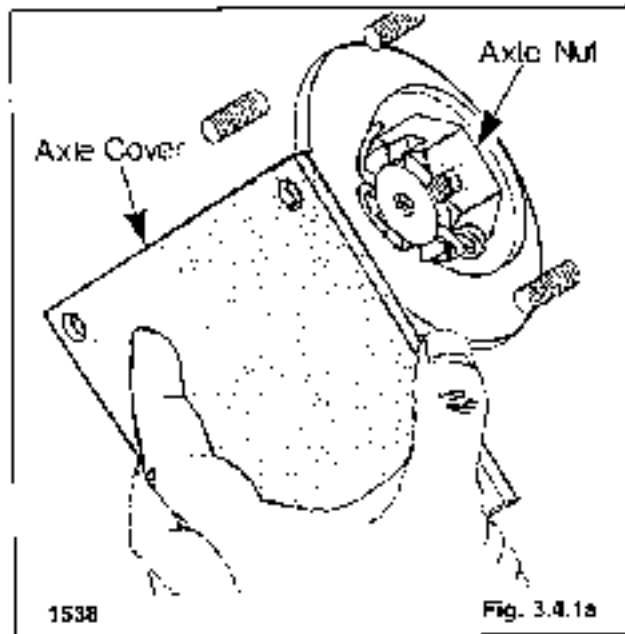
3. Remove the wheels on the side of the loader that the axle is to be removed from.

On reassembly torque the wheel nuts 100-150 ft. lbs (135-149 N.M.)

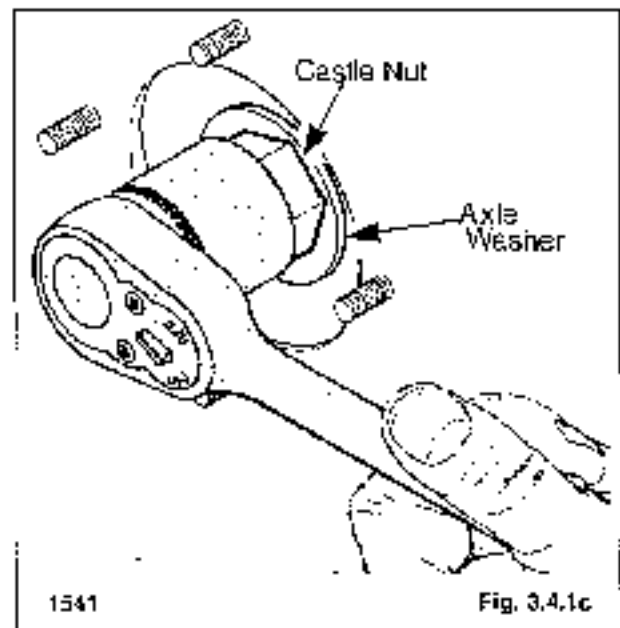
4. Drain the lubricating oil from the final drive housing. Refer to section 3.1.4 for procedure. Total housing capacity 5.5 gal. (14 l).
5. Remove the final drive inspection cover located between the two axles.
6. Remove the drive chain from the final drive housing. Refer to section 3.2.4 for procedure.

3 FINAL DRIVE

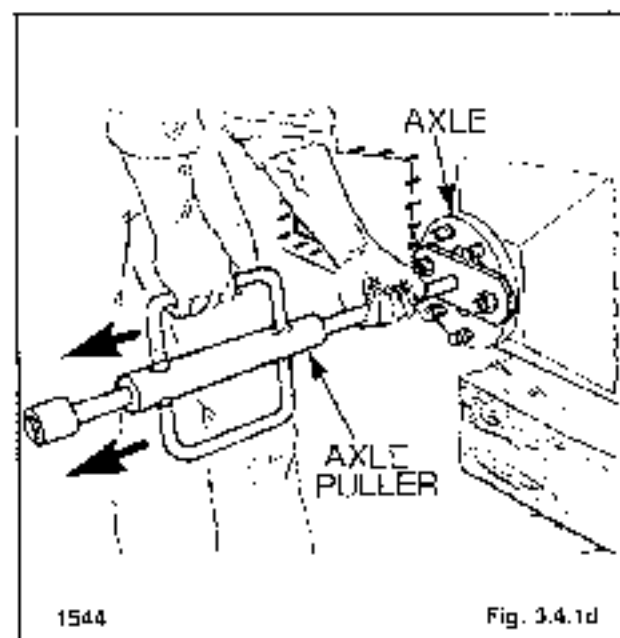
7. Remove the axle cover plate (fig. 3.4.1a) from the inside of the final drive housing.



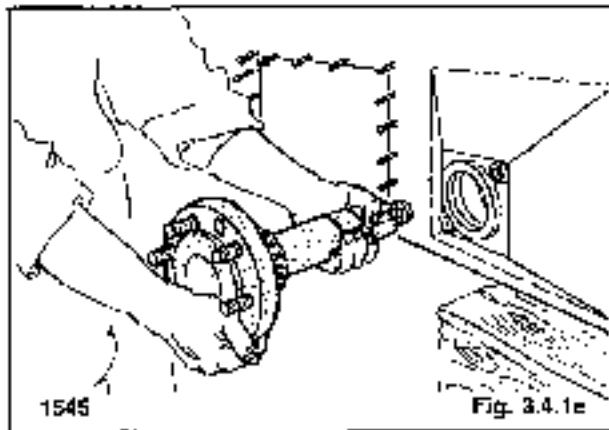
8. Remove the split pin from the castle nut on the end of the axle (fig. 3.4.1b).
9. Remove the rear castle nut, axle washers and spacer (fig. 3.4.1c).



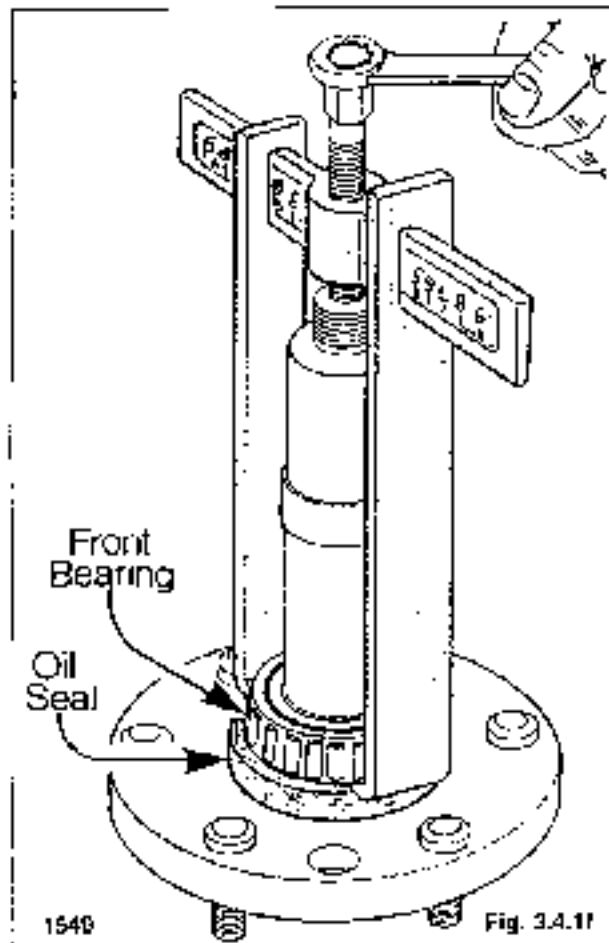
10. Attach special tool TH957372 to the axle flange (fig. 3.4.1c).
11. Using the special axle puller tool (sliding hammer) remove the rear bearing from the end of the axle (fig. 3.4.1d). The rear bearing and axle sprocket will remain inside the final drive housing.



3 FINAL DRIVE

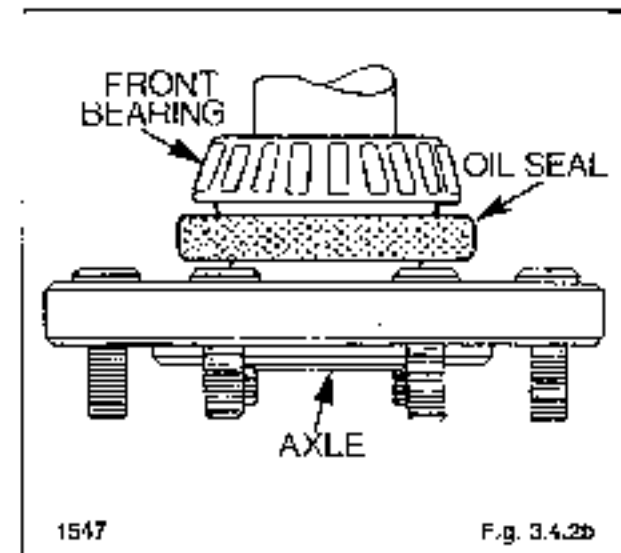
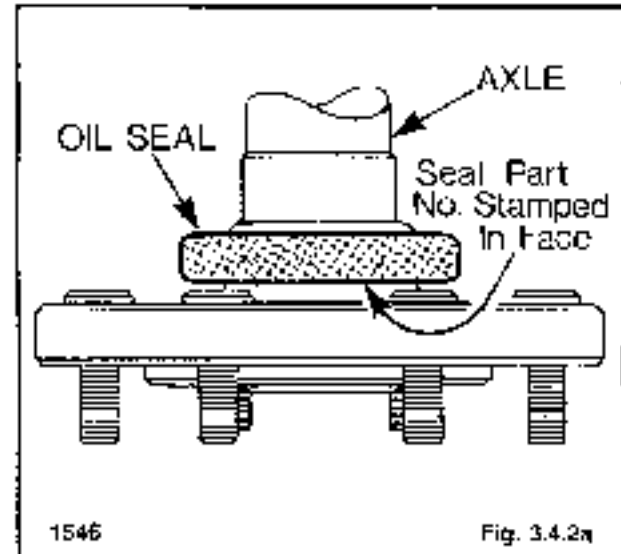


12. Remove the axle assembly from the final drive housing (fig. 3.4.1e)
13. Remove the axle sprocket and rear bearing from the final drive housing through the inspection cover.
14. Using a bearing puller remove the front axle bearing (fig. 3.4.1f) from the axle.
15. Remove and discard the axle oil seal.



3.4.2 Axle Installation:

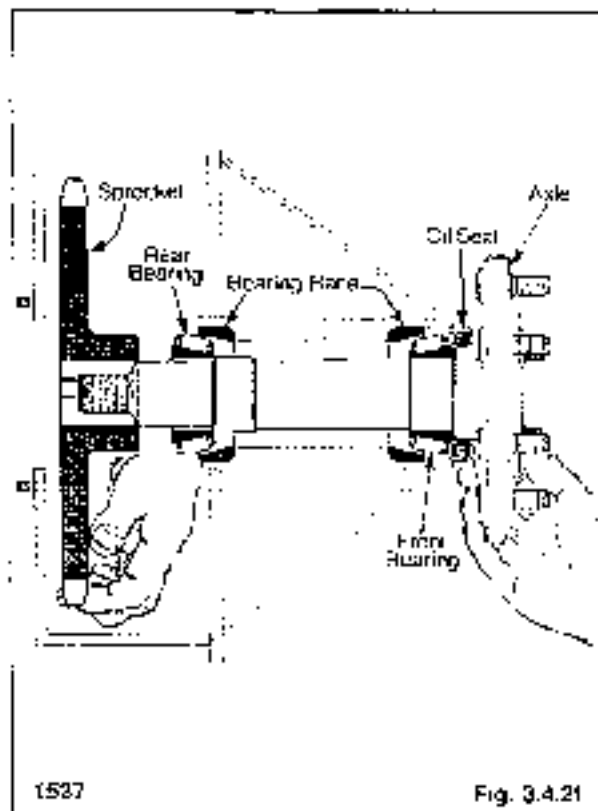
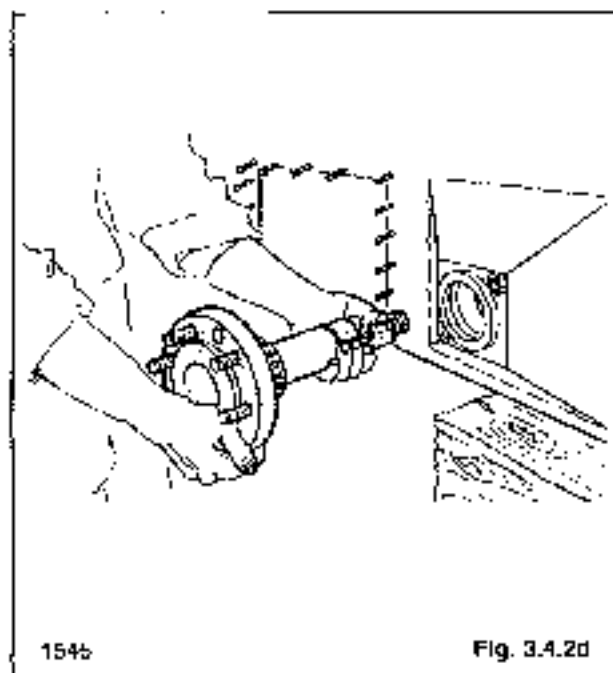
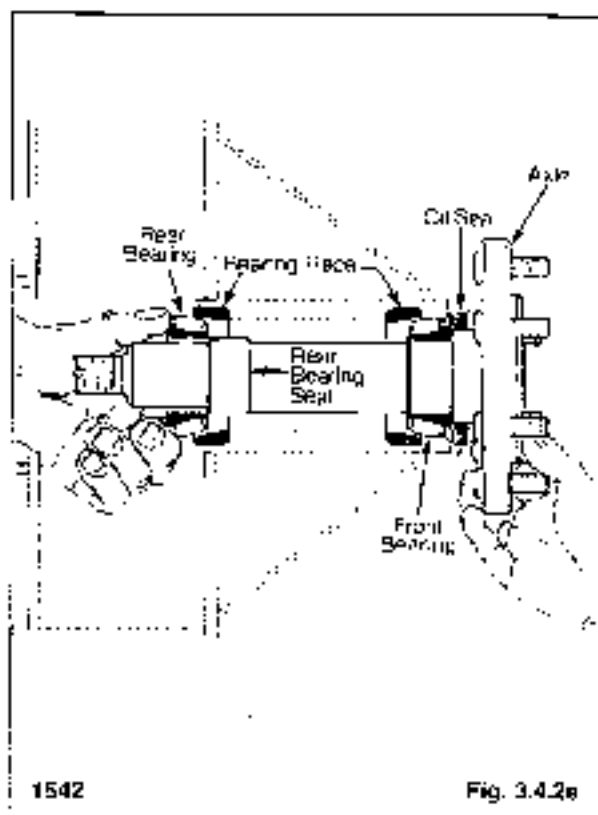
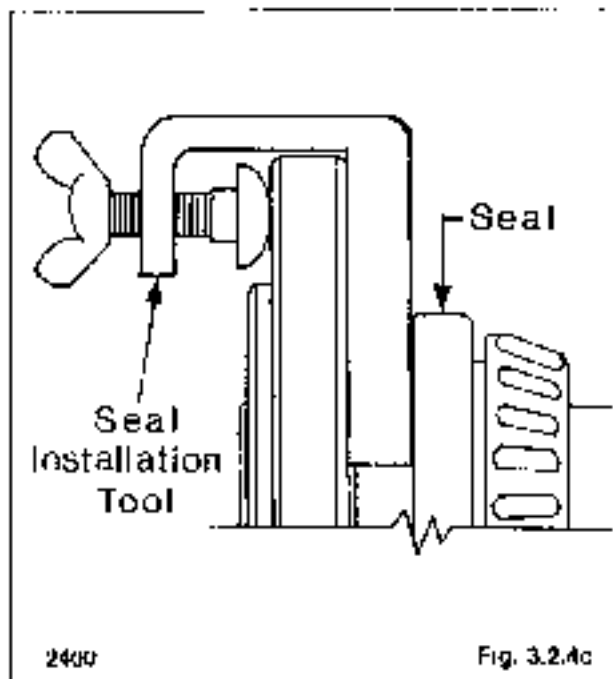
1. Lubricate the axle oil seal and install it on the seal surface of the axle. The seal part number stamped on the face of the seal must face the flange end of the axle (fig. 3.4.2a).



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 2 seal installation tools (special tool T190/189) on the axle flange (fig. 3.4.2c).

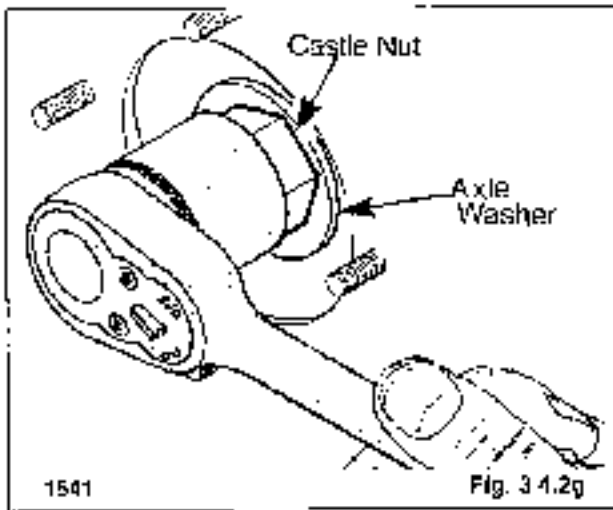
The seal installation tools will properly seat the axle seal in the final drive housing as the axle is installed.

3 FINAL DRIVE

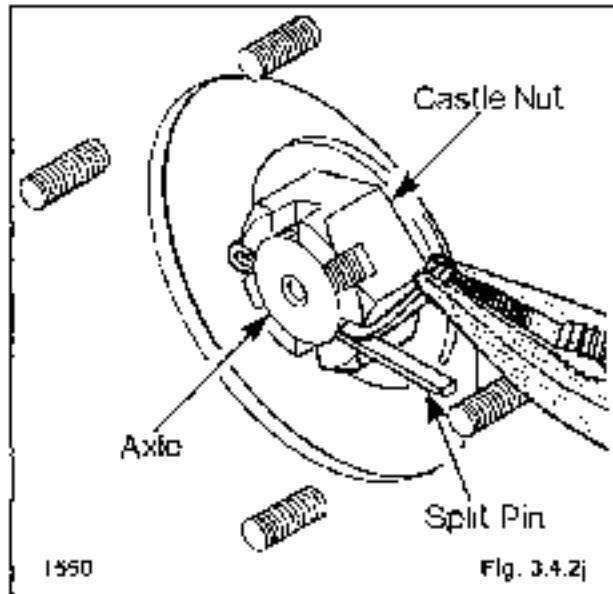


4. Install the axle in the final drive housing (fig. 3.4.2d)
5. Reach in through the inspection opening and install the rear axle bearing on the axle (fig. 3.4.2b). Line the bearing up with the bearing seat on the axle.
6. Reach in through the inspection opening and install the axle sprocket on the axle (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.

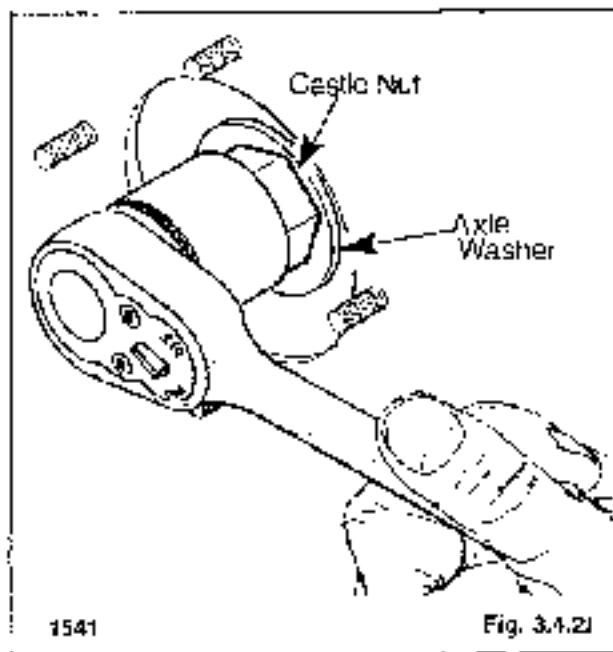
3 FINAL DRIVE



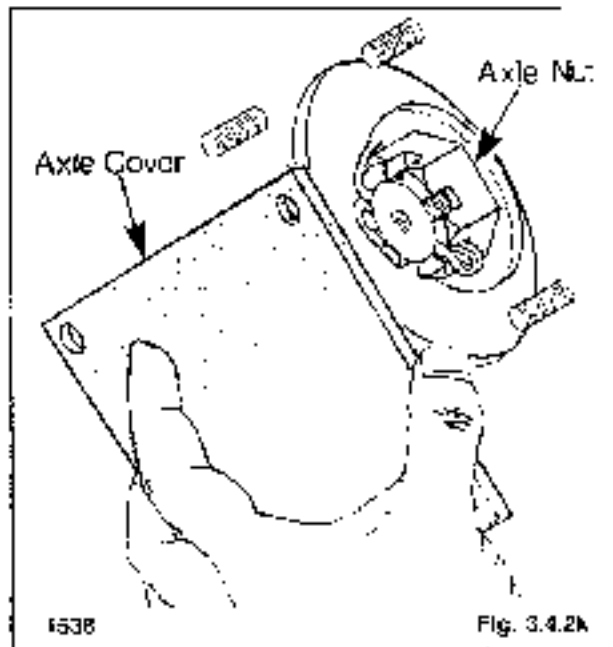
7. Install the axle spacer and castle nut (fig. 3.4.2g)
8. While tapping in on the axle tighten the castle nut until the installation tools are touching the front of the housing.
9. Remove the seal installation tools from the axle.
The axle seal should be flush with the final drive housing.



12. Install the axle cover and gasket (fig. 3.4.2k)
13. Install the drive chain and parking brake assembly. Refer to section 3.2.4 and 3.2.5 for procedure.



10. Install the axle spacer, axle washers, as required, and castle nut and preload the axle bearings to zero (0) end play (fig. 3.4.2i).
11. Install the split pin through the castle nut (fig. 3.4.2j).



14. Fill the final drive housing to the correct level with 10W30 API SE-CD oil. Refer to section 3.1.3 for procedure. Total capacity per housing 3.5 gal. (14 l).
15. Install the final drive inspection cover.
16. Install the wheels. Torque the wheel nuts 100-110 ft lbs (135-149 N.M.).

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3.4.3 Axle Stud Replacement:

IMPORTANT

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

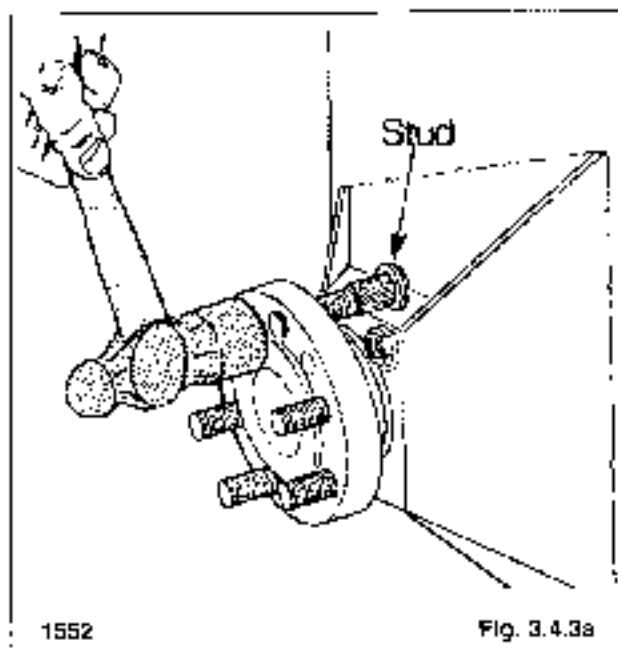
1. Lower the boom arms. Shut off the engine.



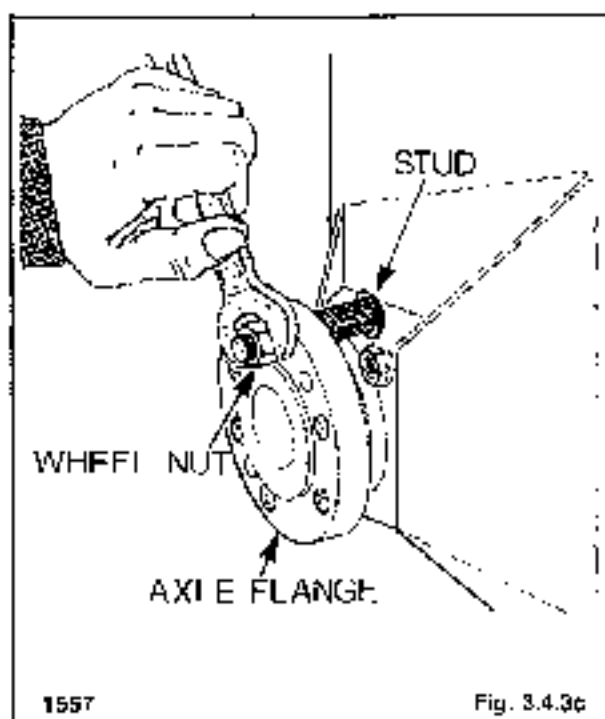
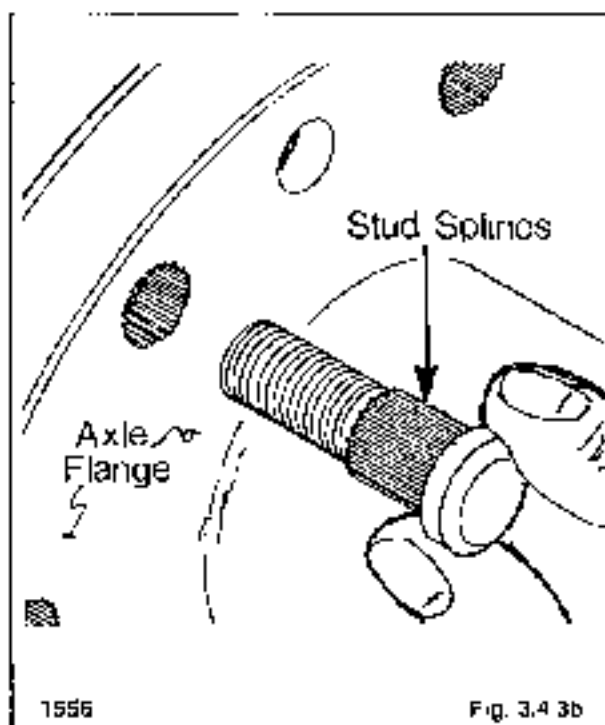
WARNING

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 studs 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. 3.4.3a)



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

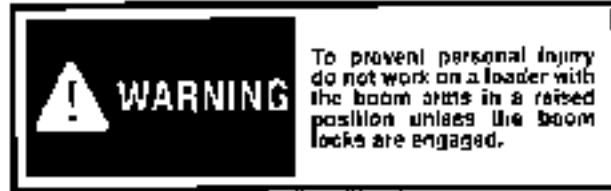
3 FINAL DRIVE

3.5 DRIVE MOTOR SPROCKET

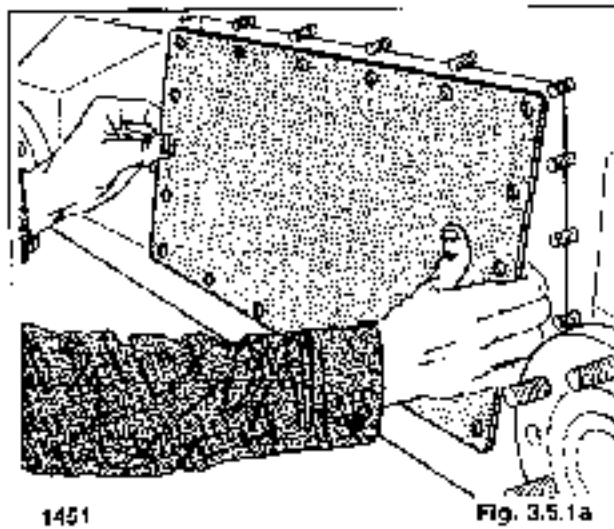
3.5.1 Sprocket Removal:

NOTE The torque motor can be removed from the final drive housing with the sprocket installed on the motor shaft.

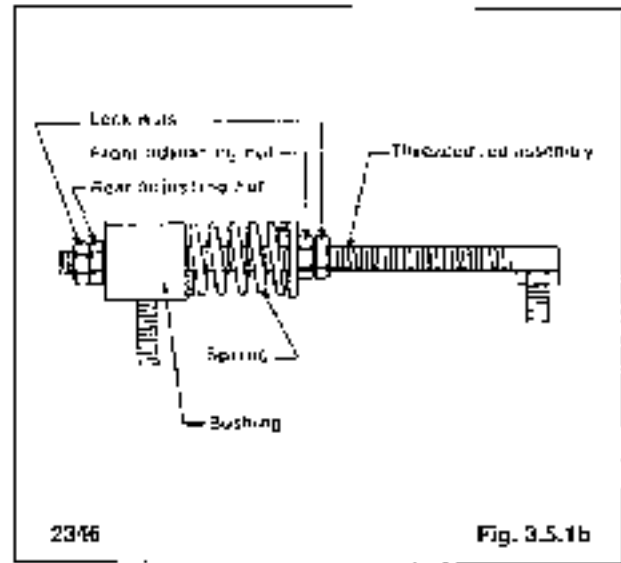
1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.



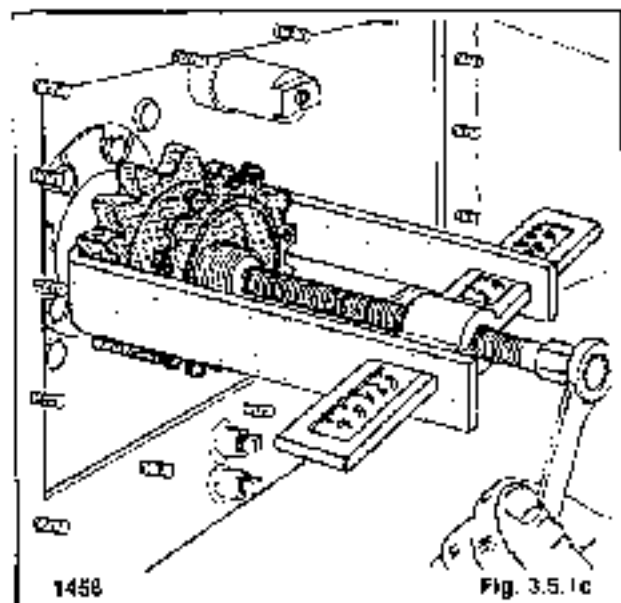
2. Block the loader securely with all four wheels clear of the ground.
3. Remove the wheels on the side of the loader that the drive motor sprocket is to be removed from.
On reassembly torque the wheel nuts 100-110 ft. lbs. (135-49 N.M.).
4. Drain the lubricating oil from the final drive housing. Refer to section 3.1.2 for procedure. Total housing capacity 3.5 gal (14 l.).
5. Remove the final drive inspection cover plate (Fig. 3.5.1a) located between the axles on the final drive housing.



6. Remove bolt end of threaded rod assembly from brake lever of caliper (Fig. 3.5.1b).



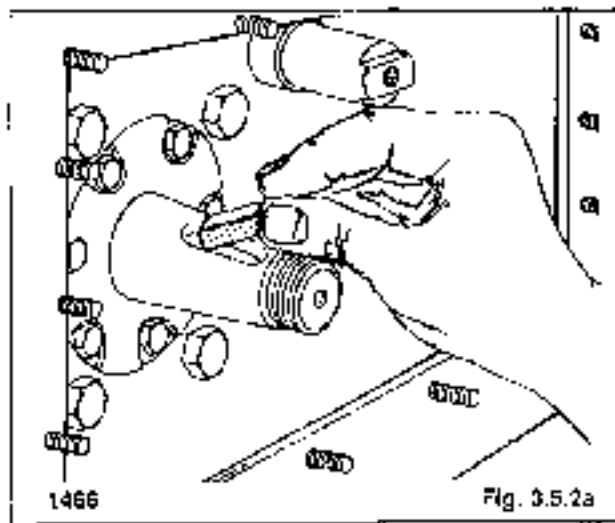
7. Loosen brake caliper assembly.
8. Remove stainless steel "Z" pin, and hex washers, from the torque motor sprocket.
9. Spread the brake pads apart, to allow removal of the brake disc.
10. Remove primary chain. Refer to section 3.2.2 for procedure.
11. Remove castle nut.
12. Using a proper gear puller, remove the sprocket and key from the torque motor shaft (Fig. 3.5.1c).



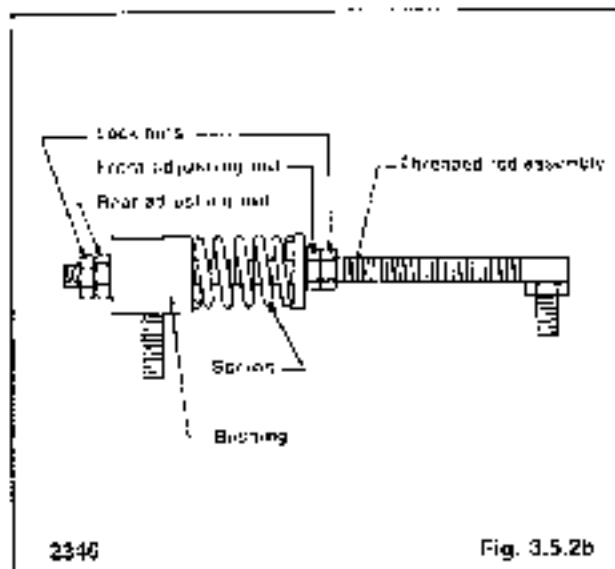
3 FINAL DRIVE

3.5.2 Sprocket Installation:

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



2. Line up the sprocket with the key and install the sprocket on the torque motor shaft.
3. Install the sprocket nut. Torque the nut to 350 ft. lbs. (474.5 N.M.).
4. Install the primary chain. Refer to section 3.2.2 for procedure.
5. Install the brake disc, hex washers, and stainless steel pin.
6. Bend both ends of pin to make a 'Z'.
7. Tighten brake caliper assembly, and reinstall threaded rod assembly (fig. 3.5.2b).



10. Fill the final drive housing to the correct level with 10W30 API SE/CD oil. Refer to section 3.1.5 for details. Capacity 2.5 gal. (14 l).
11. Apply grease to the inspection cover and install the inspection cover on the final drive housing.
12. Install the wheels. Torque the wheel nuts 100-110 ft. lbs. (135-149 N.M.).

IMPORTANT

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

3 FINAL DRIVE

3.6 TROUBLE SHOOTING — 3.6 Trouble Shooting

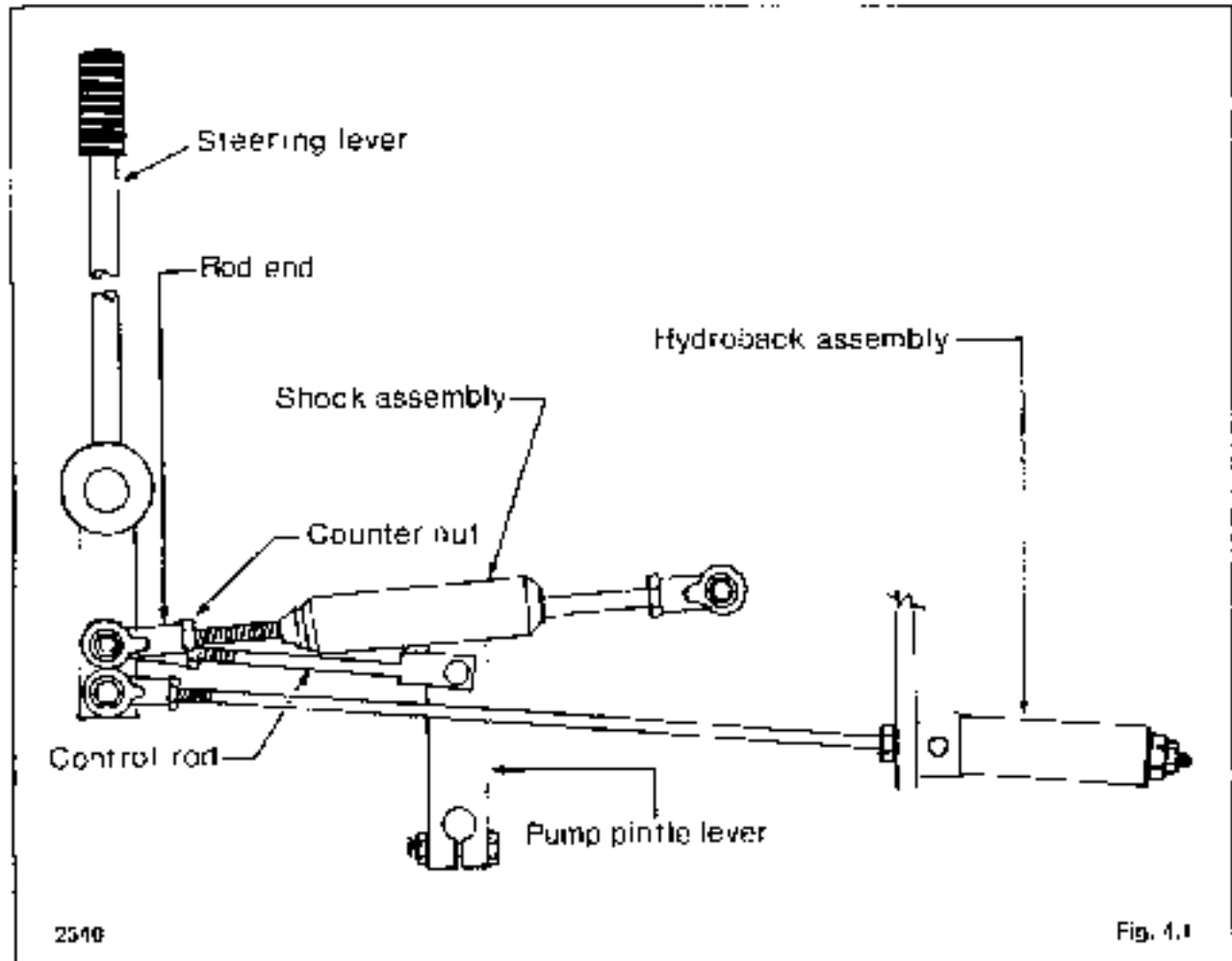
Problem	Cause	Corrective Action	Refer to Section
Final drive, Noisy	No lubricating oil	Check oil level. Add 10W30 API SE/CD to correct level. Check for leaks.	3.1.3
	Chain loose	Replace chain. Check tension every 150 hours.	3.2
	Axles have too much end play	Preload axle bearings removing all end play.	2.3.1
	Parking brake engaged, damaged or out of adjustment	Inspect and adjust or replace damaged parts.	4.3
No drive on one side	Drive chain failure	Inspect chain and connection link. Replace damaged parts. Check chain tension every 150 hours.	3.2
	Drive motor shaft failure	Inspect and replace damaged parts.	2.3
	Hydrostatic drive system failure	Refer to hydrostatic drive system.	2.4
Lubricating oil leaking through filter, breather cap	Lubricating oil level too high	Check oil level.	3.1.3
	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. (135-149 N.M.).	3.4.2
Wheel stud threads stripped	Wheel nuts over torque	Torque to 100-110 ft. lbs. (135-149 N.M.) Check torque every 8 hours.	3.4.3

SECTION 4 CONTROLS

STEERING	4.1
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Neutral adjustment ..	4.1.2
Neutral detent adjustment ..	4.1.3
Steering limiter adjustment ..	4.1.4
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Pedal lock adjustment ..	4.2.2
Pedals & Lock Removal ..	4.2.3
Safety start switch adjustment ..	4.2.4
SEAT BAR	4.3
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THROTTLE & STOP CONTROL	4.4
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PARKING BRAKE INSTALLATION & ADJUSTMENT	4.5
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Adjustment ..	4.5.2
Caliper and pad removal ..	4.5.3
Caliper and pad replacement ..	4.5.4

4 CONTROLS

4.1 STEERING CONTROLS



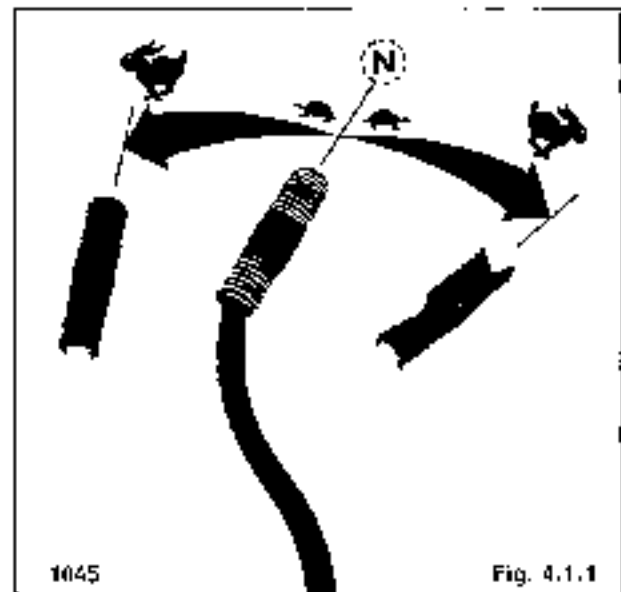
4.1.1 Operation

Two steering levers control speed, direction and turning of the loader. The steering levers are connected to the two hydrostatic drive pump 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 L.H. wheels. Loader speed is controlled by the distance each lever is moved from center or neutral position (Fig. 4.1.1).

The further away from neutral, the faster the travel speed.

For maximum power and slow travel speed move the steering levers a small amount from neutral position.



4 CONTROLS

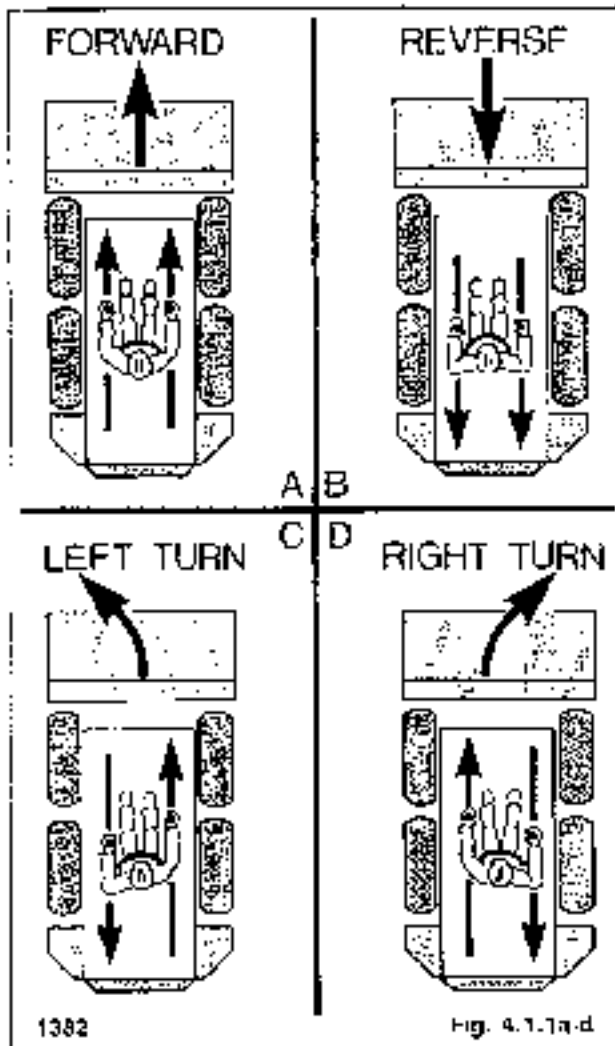


WARNING

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

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 L.H. lever further than the R.H. lever (Fig. 4.1.1d). To turn left, move the R.H. lever further than the L.H. lever (Fig. 4.1.1c).

For the loader to pivot or "skid-steer" within its own length, move one lever forward and the other back (Fig. 4.1.1c & Fig. 4.1.1d).



WARNING

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

The steering levers are equipped with a hydroback assembly which will return the steering levers to neutral position if released during operation.

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



WARNING

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

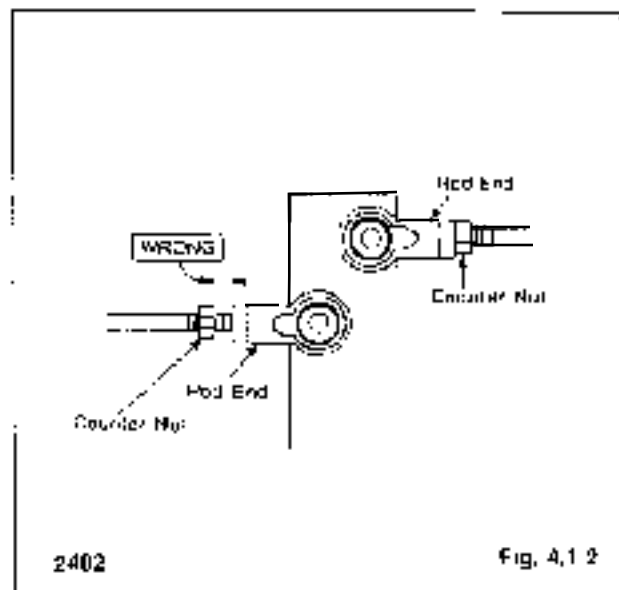
4.1.2 Neutral adjustment:

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 hydroback system may require adjustment.

Before making any adjustment on the hydroback system check the entire steering linkage for free play. If any free play exists, in the linkage, adjustment of the spring return system will not be possible.

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



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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).

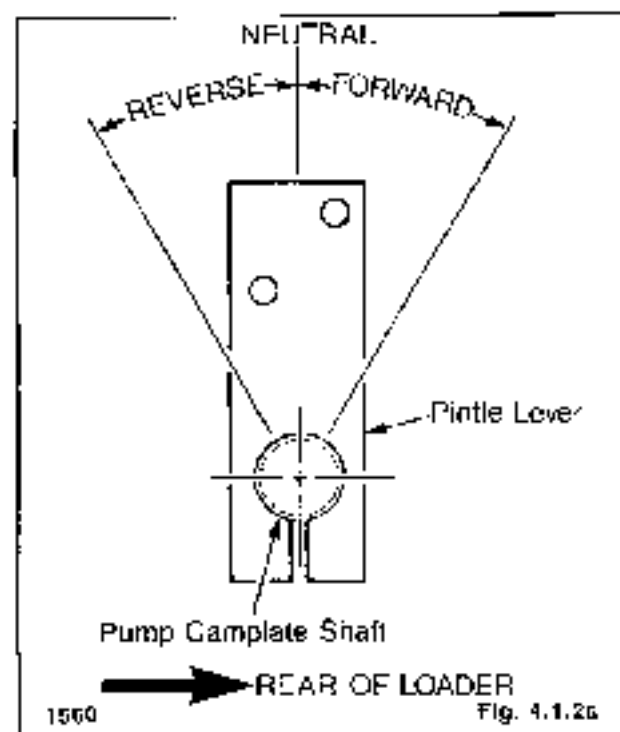
Check the pintle lever clamp bolt and rollpin for tightness and wear (Fig. 4.1.2).

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

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



2. Block the loader securely with all four wheels clear of the ground.
3. Remove the seal.
4. Determine which direction the pump pintle lever must move to place the pump in neutral position (Fig. 4.1.2a).



If the loader is creeping forward the pump pintle lever must be moved toward the front of the loader.

If the loader is creeping backward the pump pintle lever must be moved toward the rear of the loader.

The pintle position should only be adjusted at the hydroback assembly.

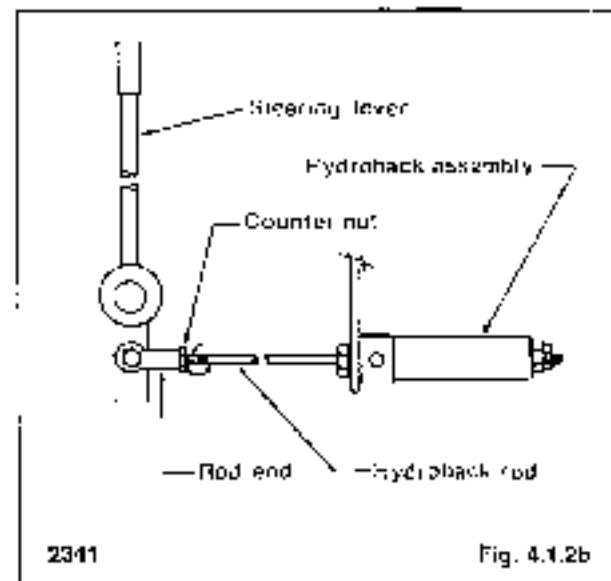
5. Lower the seat bar to release the steering neutral control linkage.

The following instructions cover the adjustment procedure to correct both forward and reverse loader creep.

6. LOADER CREEPING FORWARD:



- A. Slacken the counter nut on the rod end of hydroback rod one or two turns (Fig. 4.1.2b).



- B. Turn hydroback rod out a turn or two.

NOTE: There must be a min. of 3/8 inch of threads engaged in rod end to prevent stripping of threads.

- C. Lower the seat and start the engine and check for wheel creep. If additional adjustment is required shut off the engine and repeat steps A and B.

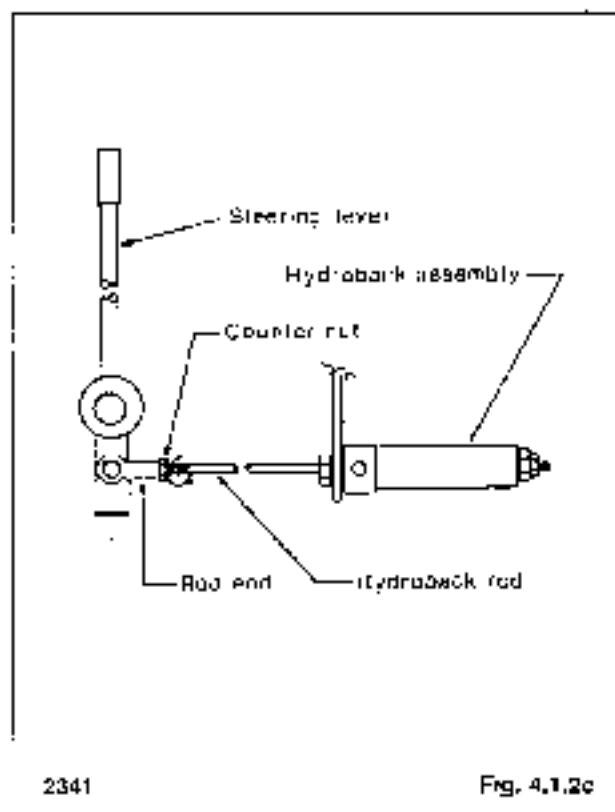


4 CONTROLS

7. LOADER CREEPING REARWARD:



- A. Slacken the counter nut on the rod end of hydroback one or two turns (fig. 4.1.2c).



- B. Turn hydroback rod in a 1/4th or two.

NOTE: There must be a min. of 3/8 inch of threads engaged in rod end to prevent stripping of threads.

- C. Lower the seat and start the engine and check for wheel creep. If additional adjustment is required shut off the engine and repeat steps A and B.



8. Tighten the counter nuts against the rod end while preventing the hydroback rod from turning.
9. After performing the neutral adjustment it may be necessary to adjust the steering lever neutral detent linkage.



Lower the seat and start the engine. With the seat bar up, check for wheel creep.

If wheel creep is detected refer to section 4.3.2 for seat bar and neutral detent adjustment.

4.1.3 Neutral Detent Adjustment:

For safety during start up the steering control levers are designed to be automatically centered in neutral position when the seat bar is in the up position.

When the seat bar is lowered into the operating position, the steering lever centering or neutral detent linkage is released.

If the loader creeps while the engine is running and the seat bars in the up position, the neutral detent linkage may require adjustment for the complete adjustment procedure refer to section 4.3.2.

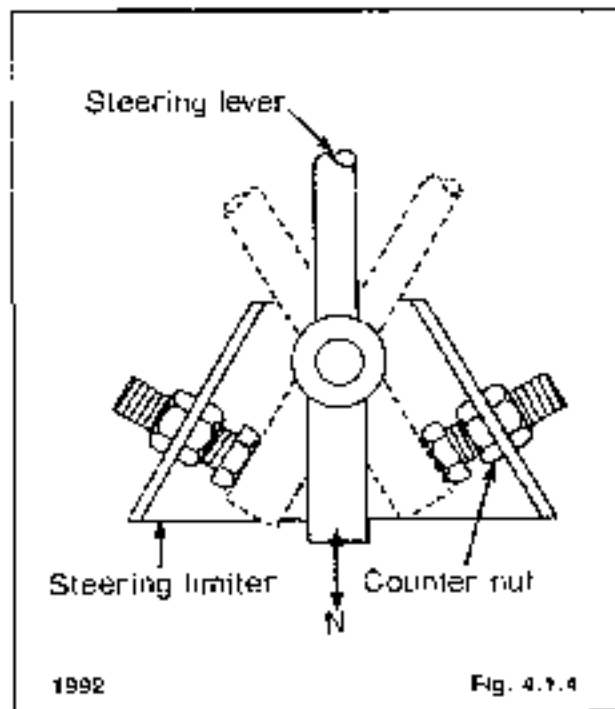
4.1.4 Steering Limiter—Adjustment:

To prevent power loss while making a pivot or "SKID-SLIP" turn, the steering control levers are equipped with stroke limiter.

Adjust the steering limiter as follows:

1. Raise the seat, remove the sound insulation and hydrostatic shield.
2. Lower the seat bar.
3. Move the R.H. steering control lever full forward and adjust the limiter stop bolt against the control lever (Fig. 4.1.4). Tighten the counter nut.
4. Move the R.H. steering control lever full back and adjust the lever stop bolt against the control lever (Fig. 4.1.4). Tighten the counter nut.

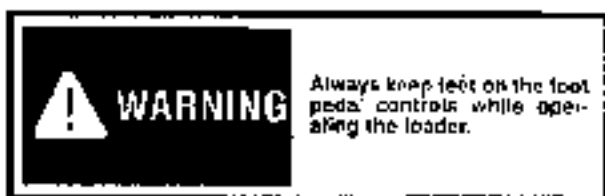
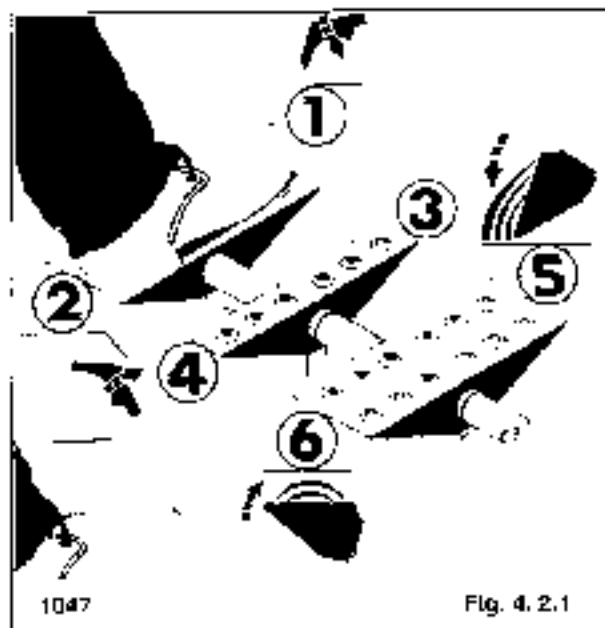
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4.2 FOOT PEDALS

4.2.1 Operation:

Operation of the boom lift cylinders, bucket lift cylinders and auxiliary hydraulic circuit are controlled by foot pedals (Fig. 4.2.1) connected to a hydraulic control valve. The hydraulic control valve is a series type valve which allows simultaneous use of both the boom lift and bucket lift circuits.



BOOM LIFT:

The L.H. pedal is the boom lift control (Fig. 4.2.1). 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 (2) of the pedal will lock the boom in that position. This allows the bucket to follow the ground as the loader moves backward.

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 direct 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.



BUCKET LIFT:

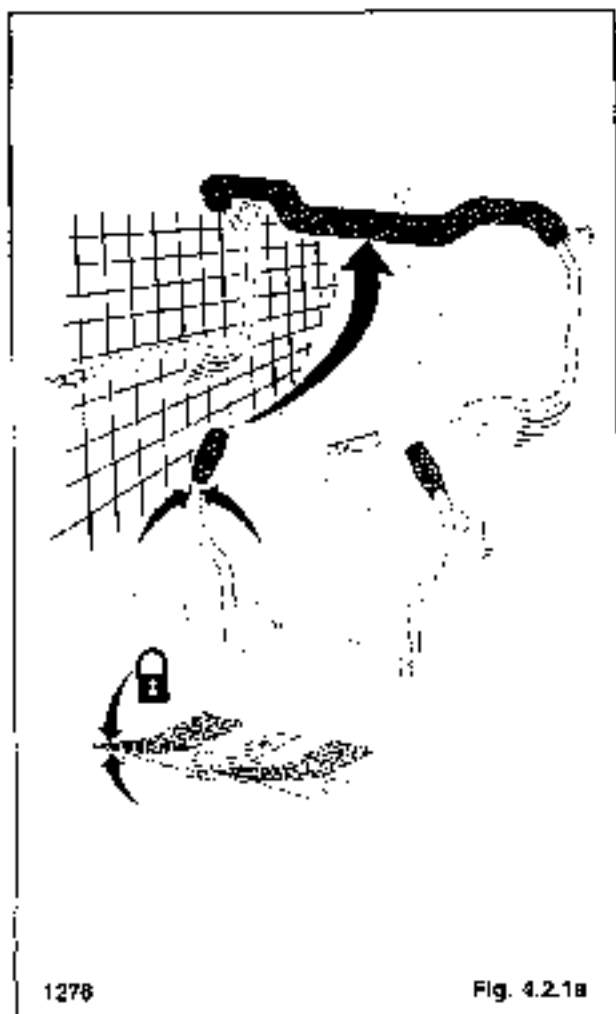
The R.H. pedal is the bucket lift (dump) control. Pressing on the toe (5) of the pedal will dump the bucket. Pressing on the heel (6) of the pedal will roll the bucket back.

SAFETY EQUIPMENT:

The pedal lock is operated by the raising and lowering of the seat bar (Fig. 4.2.1a).

As the seat bar is raised, the pedal lock engages, locking the foot pedals in neutral position (Fig. 4.2.1b).

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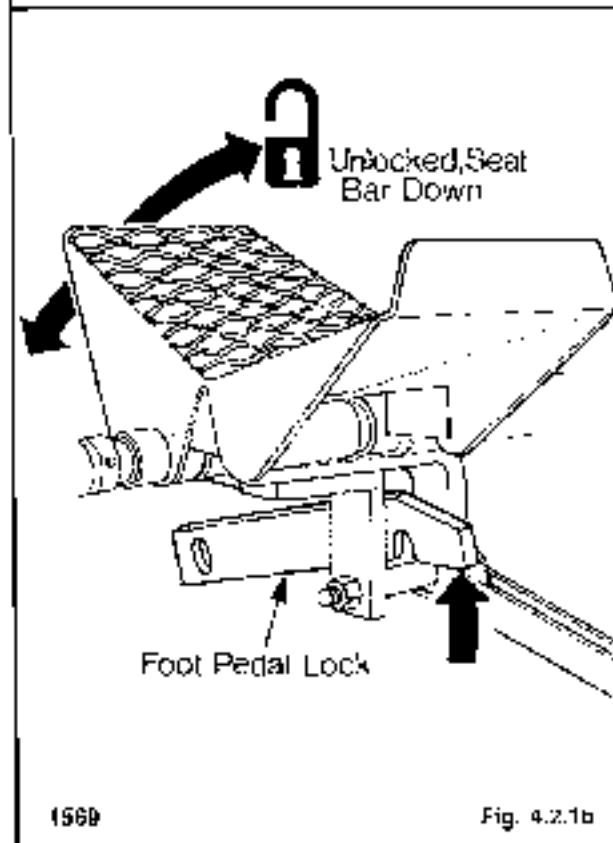
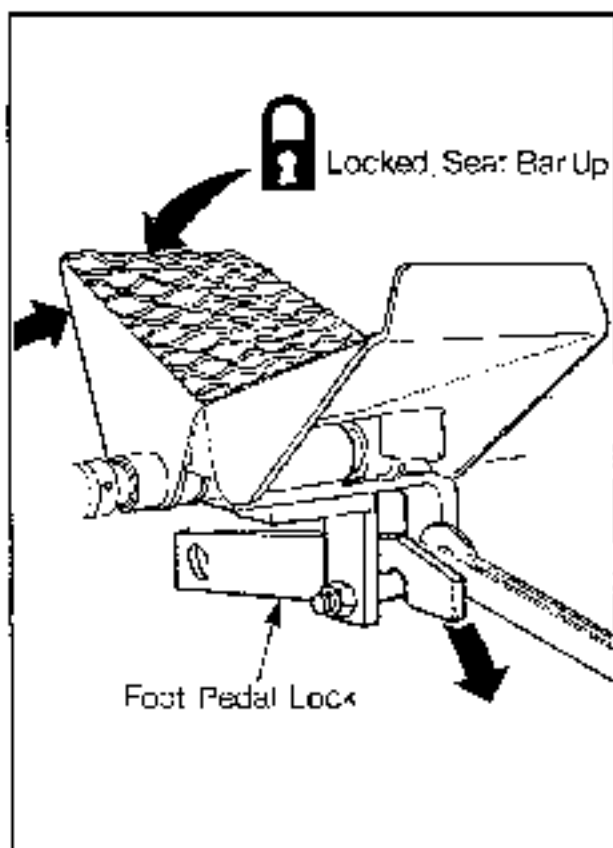
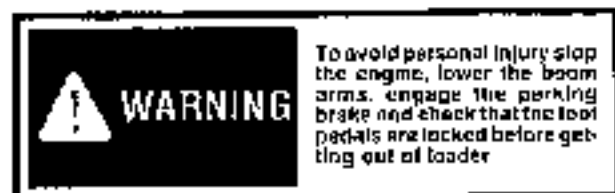
Fig. 4.2.1a

At the same time the steering levers are locked in the neutral position.

As the seat bar is lowered the foot pedal lock disengages freeing the pedals for operation.

For operator protection during start up, the loader starting circuit is designed so that the engine must be started with the seat bar up, foot pedals locked and the steering levers in neutral. A safety start switch disengages the starter circuit when the seat bar is down.

For emergency starting with the seat bar down, the loaders are equipped with an over-ride starting switch. (Refer to section 5).



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Fig. 4.2.1b

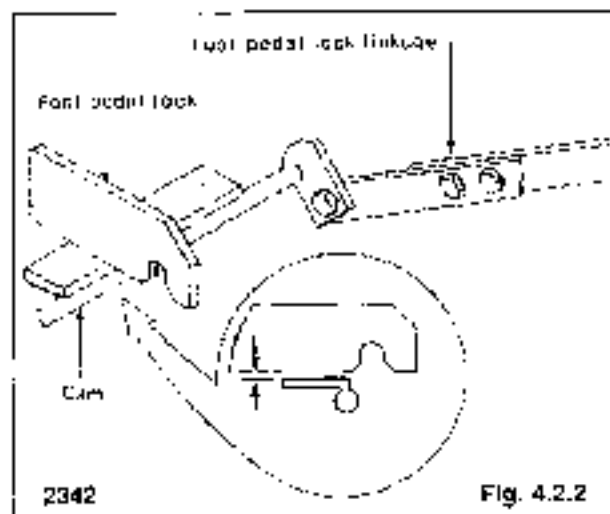
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4.2.2 Pedal Lock — Adjustment

When the seat bar is in the up position the foot pedals must be locked in neutral.

If the pedals can be moved, causing hydraulic flow, with the seat bar up, adjustment or repair of the lock linkage may be required.

To adjust, raise the seat bar and lock it in the up position. Ensure the cam, which raises the foot pedal locking arms (Fig. 4.2.2), is in a horizontal position and is not applying any lift tension on the foot pedal lock arms.



Adjust the foot pedal lock linkage (Fig. 4.2.2) so that no downward tension is applied to the locking arms with the seat bar up.

If no upward tension is being applied by the cam (Fig. 4.2.2) but the hydraulic valve can be activated, with the seat bar up, it may be necessary to adjust the position of the control valve. Refer to section 4.2.3.

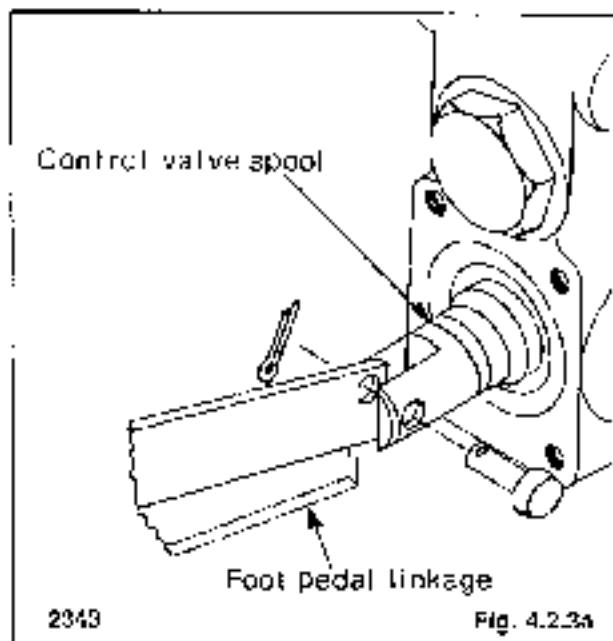
Check the foot pedal lock for correct operation each time the loader is operated. Keep all shafts, springs and linkages lubricated with WD40 or similar lubricant. Keep the foot pedal area clean. Do not allow dirt or any material to build up around the foot pedals or linkages which may affect the locking mechanism.

4.2.3 Foot Pedal — Removal

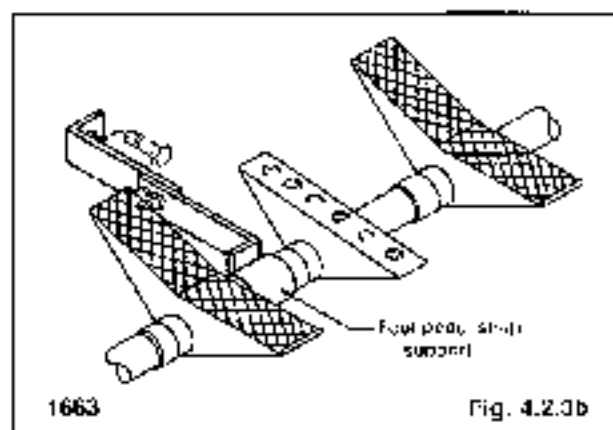
1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.



2. Raise the seat, remove hydrostatic shield and sound insulation.
3. Disconnect the pedal lock linkage from the foot pedal shaft (Fig. 4.2.2).
4. Disconnect the foot pedal linkage from the control valve spool (Fig. 4.2.3a).



5. Disconnect the foot pedal shaft support from the main frame (Fig. 4.2.3b).

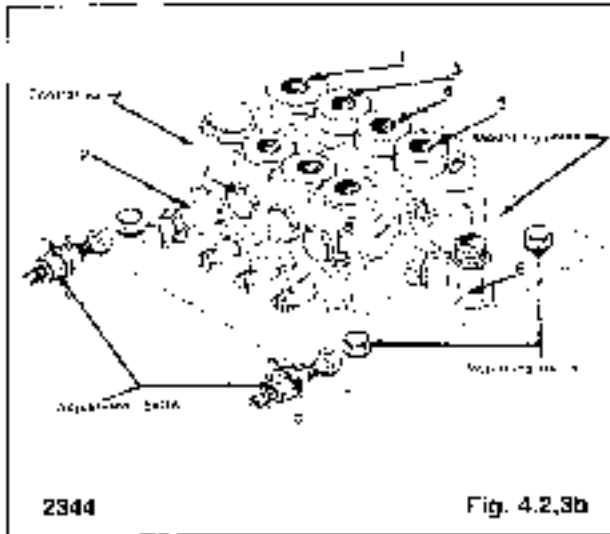


6. Remove the bolts and nuts from the bearings at each end of the foot pedal shaft.
7. Remove the foot pedals and shaft assembly from the main frame.
8. Remove the foot pedal lock assembly from the main frame.

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FOOT PEDAL & LOCK — INSTALLATION

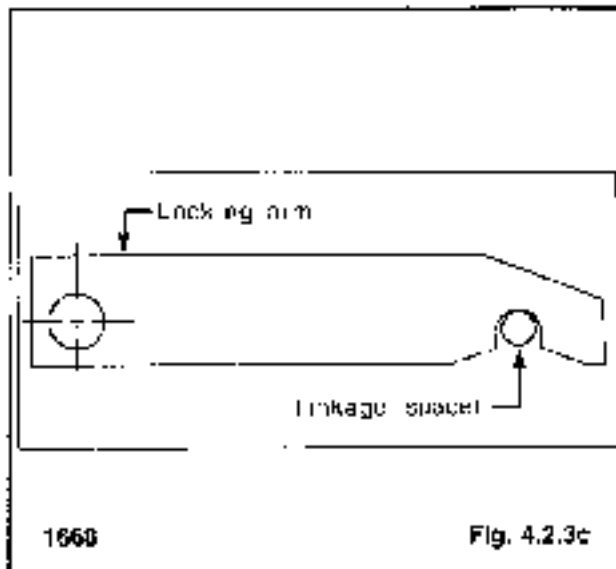
1. If the control valve had been removed, install the control valve and mounting bolts. Do not tighten the mounting bolts.



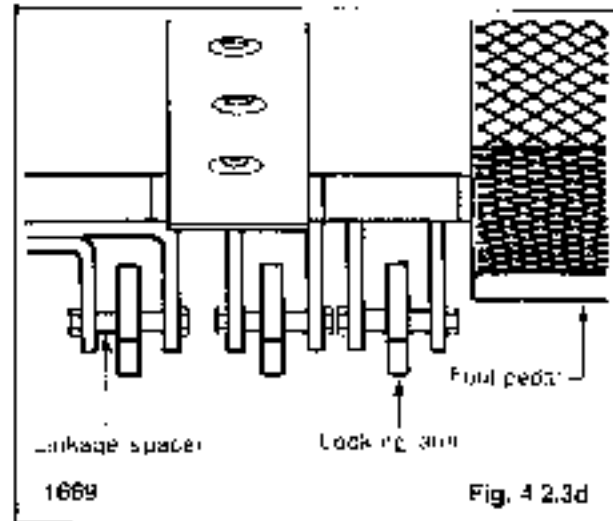
2. If the control valve has not been removed it may be necessary to adjust the control valve.
3. Install the foot pedal and shaft assembly in the loader.

Push down on the foot pedal shaft as far as it will go while the shaft bearing nuts are tightened.

4. Install the foot pedal lock assembly in the loader. Ensure the locking arms on the foot pedal lock assembly are fully engaged on the foot pedal linkage spacers (Fig. 4.2.3c).

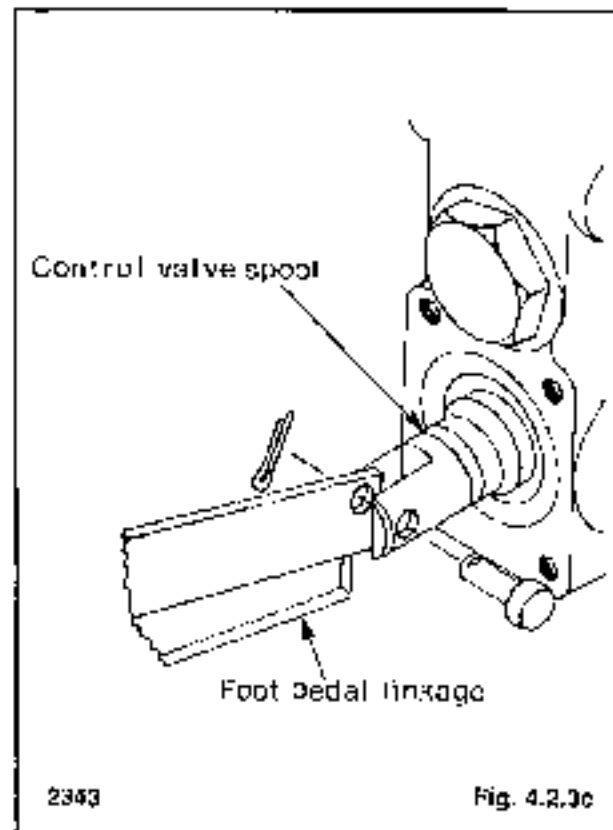


5. Line up the lock assembly by centering the locking arm on the auxiliary foot pedal linkage spacer (Fig. 4.2.3d).



Tighten the lock assembly in place making sure the mounting nuts are on the outside of the main frame.

6. Install the foot pedal linkage between the foot pedals and the control valve spools (Fig. 4.2.3e).



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7. Install the foot pedal shaft support (Fig. 4.2.3f).

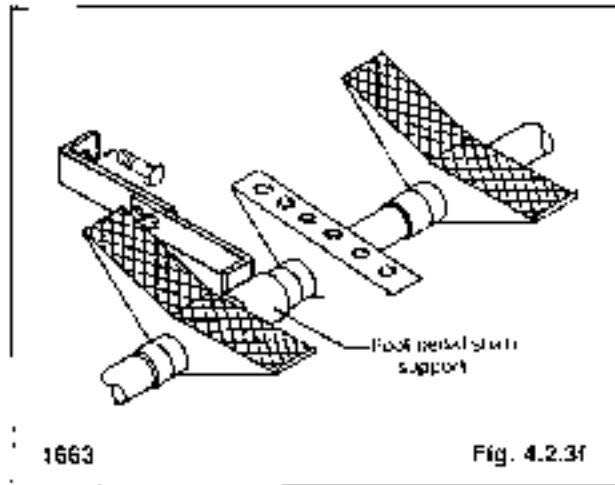


Fig. 4.2.3f

8. Install the pedal lock linkage to the foot pedal shaft (Fig. 4.2.3g).

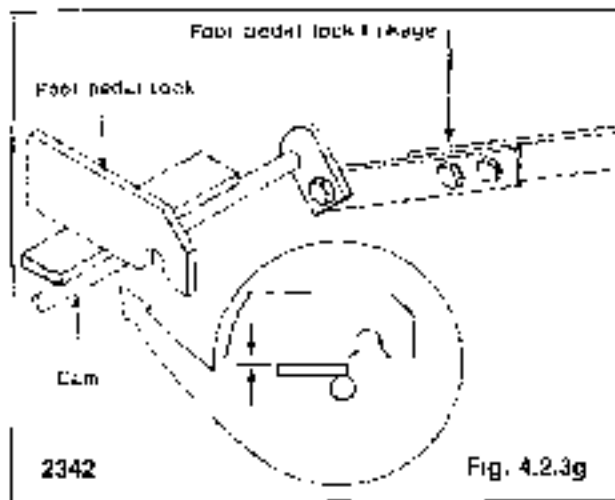


Fig. 4.2.3g

9. Ensure the cam which raises the foot pedal locking arms does not touch the locking arms (Fig. 4.2.3g).

The purpose of the foot pedal locking system is to prevent movement of the control valve spool causing accidental activation of the hydraulic system by stepping on the foot pedals when entering or exiting the loader.



10. The control valve spool must move approximately .110" (.28 mm) either side of neutral position before hydraulic flow occurs (Fig. 4.2.3h).

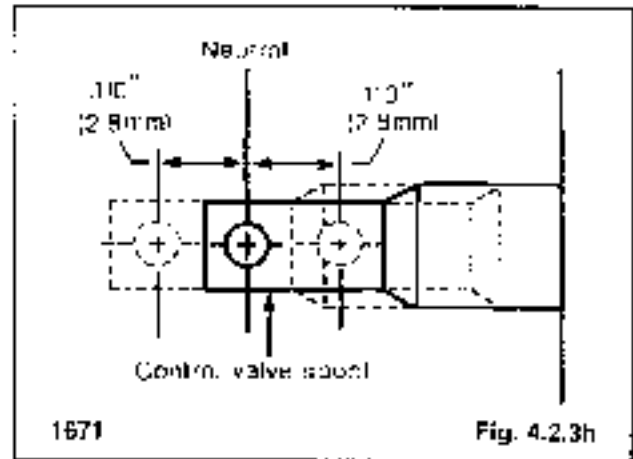


Fig. 4.2.3h

11. To prevent accidental control valve spool movement and accommodate for linkage wear the linkage is adjusted so that there is a maximum of .030 in (.75 mm) clearance on both sides of the linkage spacer and locking arm (Fig. 4.2.3i).

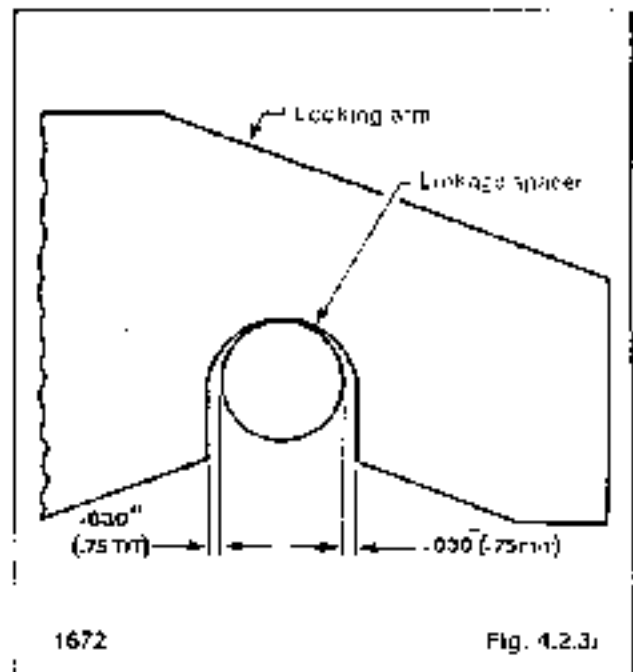


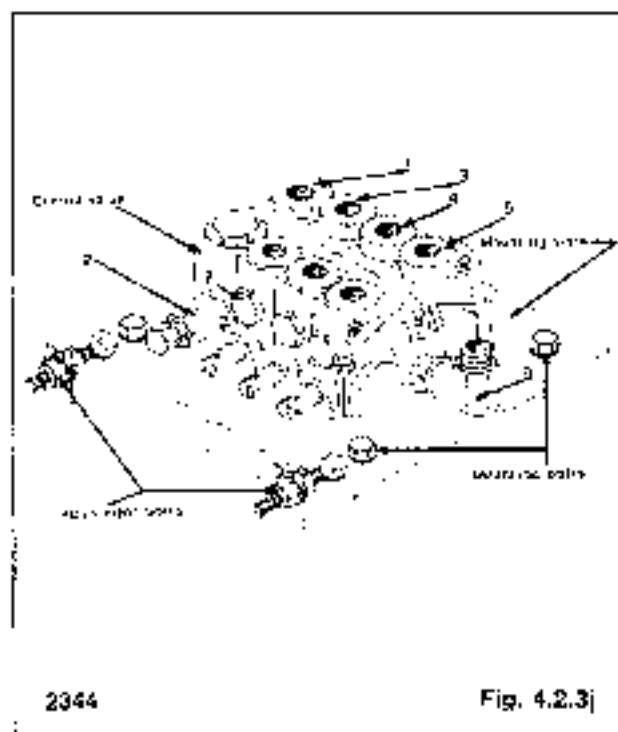
Fig. 4.2.3i

12. This clearance is obtained by the positioning of the hydraulic control valve.

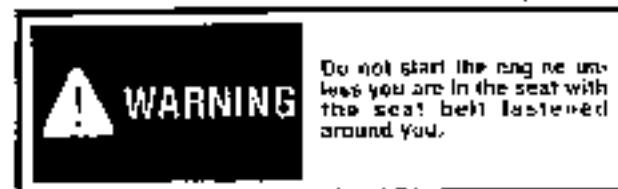
13. Loosening the four valve plate mounting bolts will allow adjustment of the valve.

4 CONTROLS

14. Loosen the four valve plate mounting bolts (Fig. 4.2.3j).



15. Determine which way the valve must move to center locking arms (Fig. 4.2.3i).
16. Move the valve ahead or back as required using the adjustment bolts (Fig. 4.2.3j).
17. Tighten the adjustment bolt counter nuts. Torque the four control valve plate mounting bolts 12-15 ft. lbs. (16-20 N.M.).
18. Test the foot pedal locks by cycling the pedals with the engine running and the seat bar up.



19. If any movement occurs in the hydraulic system shut off the engine and readjust the valve position.

Test the foot pedals with the seat bar down to ensure the pedals move freely and do not bind.

Check the operation of the foot pedal lock each time the loader is used. Keep all shafts, springs and linkages lubricated with WD40 or a similar lubricant.

4.2.4 Safety Start Switch — Adjustment

For operator safety during start-up the loader is equipped with a safety start switch connected to the loader's starting circuit. The safety start switch is a normally closed switch.

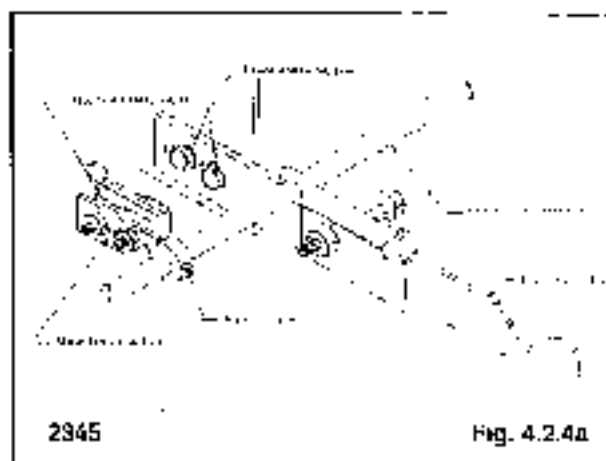
The safety start switch is engaged and disengaged by the pintle lock assembly.

When the seat bar is in the down position (Fig. 4.2.4a) the lever in the safety start switch is moved inward disengaging the starting circuit. The loader must be started with the seat bar up.

When the seat bar is in the up position the lever on the safety start switch moves outward completing the starting circuit.

Adjust the safety start switch as follows:

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

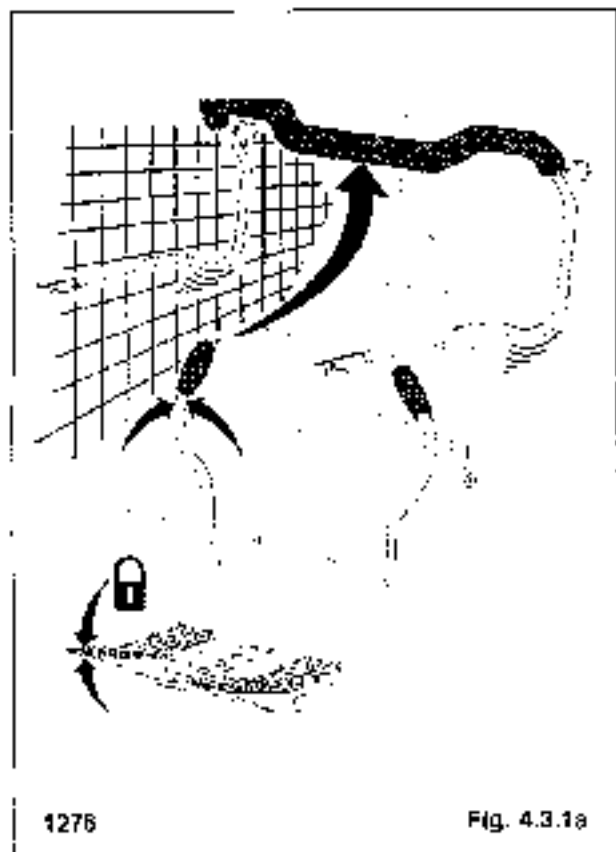
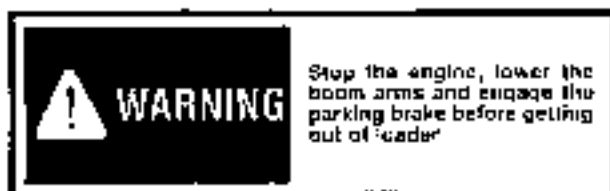


2. Check to ensure the safety start switch is securely screwed into the mounting bracket.
3. With the seat bar in the full down position, loosen the allen screw which secures the safety start switch mounting bracket.
4. Rotate the mounting bracket until the lever on the end of the safety start switch is fully depressed against the loader cross member.
5. Tighten the allen screw.

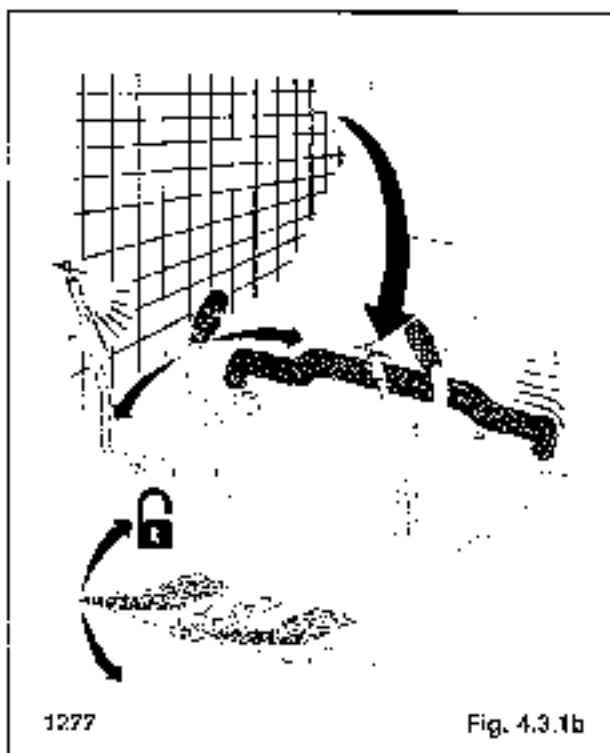
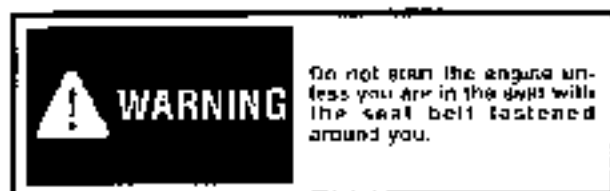
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4.3.1 Seat Bar — Operation

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 levers are returned to and restricted in neutral position. The foot pedals are locked to prevent accidental cycling of the foot pedals when entering or exiting the loader.



When the seat bar is lowered to the operating position (Fig. 4.3.1b) the foot pedals and the steering levers are free to move.



A safety start switch locks out the loader starting circuit when the seat bar is lowered. The loader must be started with the seat bar in the up position.

For restarting the loader during operation in the event the engine stalls, the loader is equipped with an over-ride starting switch.

The over-ride starting switch allows the engine to be started with the seat bar lowered. Refer to section 5.2.9.

4.3.2 Seat Bar — Adjustment

The following procedure is for the complete adjustment of the seat bar linkage, steering lever detent, and foot pedal shield.

Before making any adjustment check that the machine does not creep with the engine running, seat bar in the down position and the steering levers in neutral. If wheel creep is detected, the steering level neutral adjustment will have to be completed before proceeding to the following adjustments. Refer to section 4.1.2 for procedure.

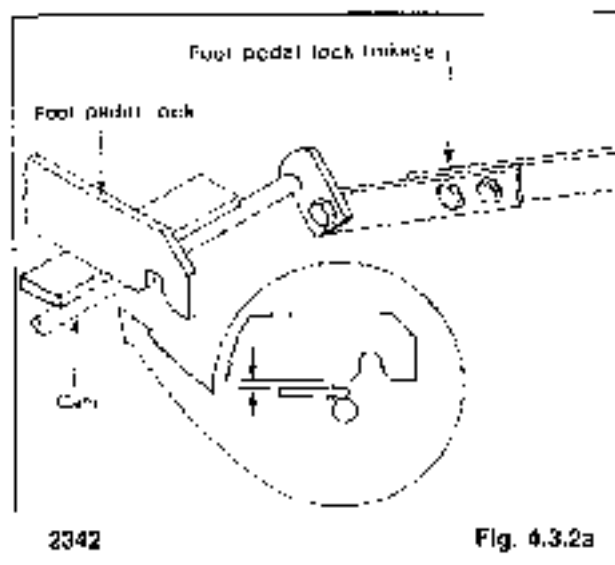


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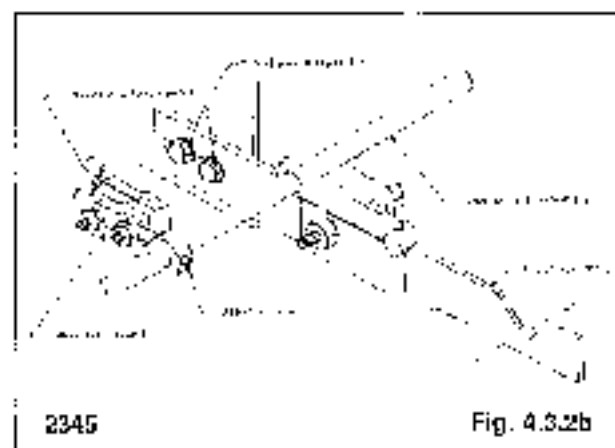
1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.



2. Remove the seat, step shield, floor plate and front step shield.
3. Lock the seat bar in the up position.
4. Loosen the foot pedal lock linkage adjustment nuts (Fig. 4.3.2a).



5. Loosen the adjustment bolts on both the L. H. and R. H. pivot assemblies (Fig. 4.3.2b).



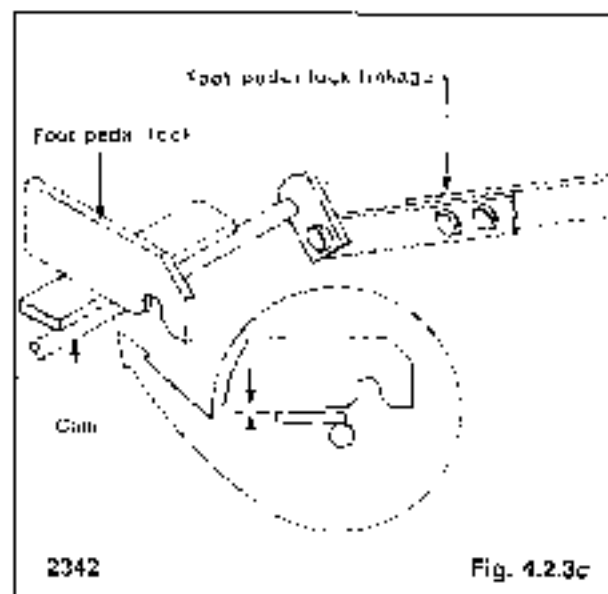
6. With the steering levers in neutral position, adjust the L. H. pivot assembly so the 'V' is lined up on the pintle lever.

Tighten the pivot assembly bolts on the L. H. side.

7. With the steering levers in neutral position, adjust the R. H. pivot assembly so the 'V' is lined up on the pintle lever.

Tighten the pivot assembly bolts on the R. H. side.

8. Adjust and tighten the foot pedal lock linkage (Fig. 4.3.2c).



Adjust the linkage so that no upward tension is applied by the cam on the foot pedal lock arms.

9. Check that with the engine running and the seat bar in the up position that the loader does not creep. Shut off the engine.

If the loader creeps readjust the pivot assemblies.



10. Lower the seat bar and with the engine off, check to ensure the foot pedals and the steering control levers move freely without binding.

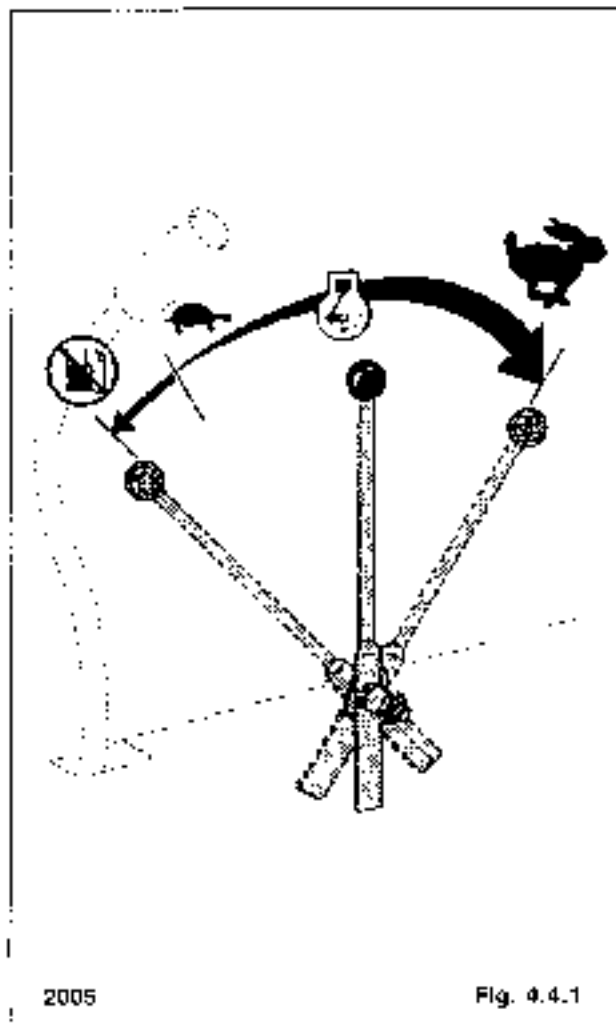
Keep all shafts, springs and linkages lubricated with WD40 or a similar lubricant.

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4.4 THROTTLE & STOP CONTROL

4.4.1 Throttle & Stop Control — Operation

The diesel engine throttle and stop control is incorporated in one lever located on the left hand side of the loader next to the steering control lever (Fig. 4.4.1).



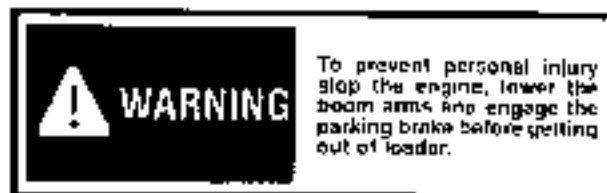
Pushing the lever full forward increases the engine speed to maximum high idle. Pulling the lever back decreases the engine RPM. Pulling full back on the lever will shut off the fuel supply stopping the engine. The engine should always be operated at full speed and the loader travel speed controlled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



4.5 PARKING BRAKE

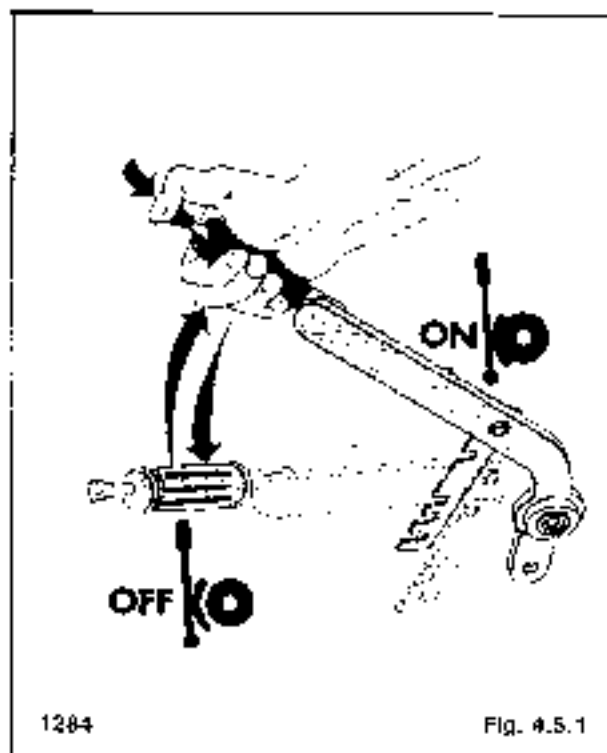
4.5.1 Operation:

The loader is equipped with two mechanical, caliper type disc brakes mounted on the output shaft of each hydrostatic drive motor. Both brakes are activated by one hand lever located on left hand side of the loader next to the operators seat.



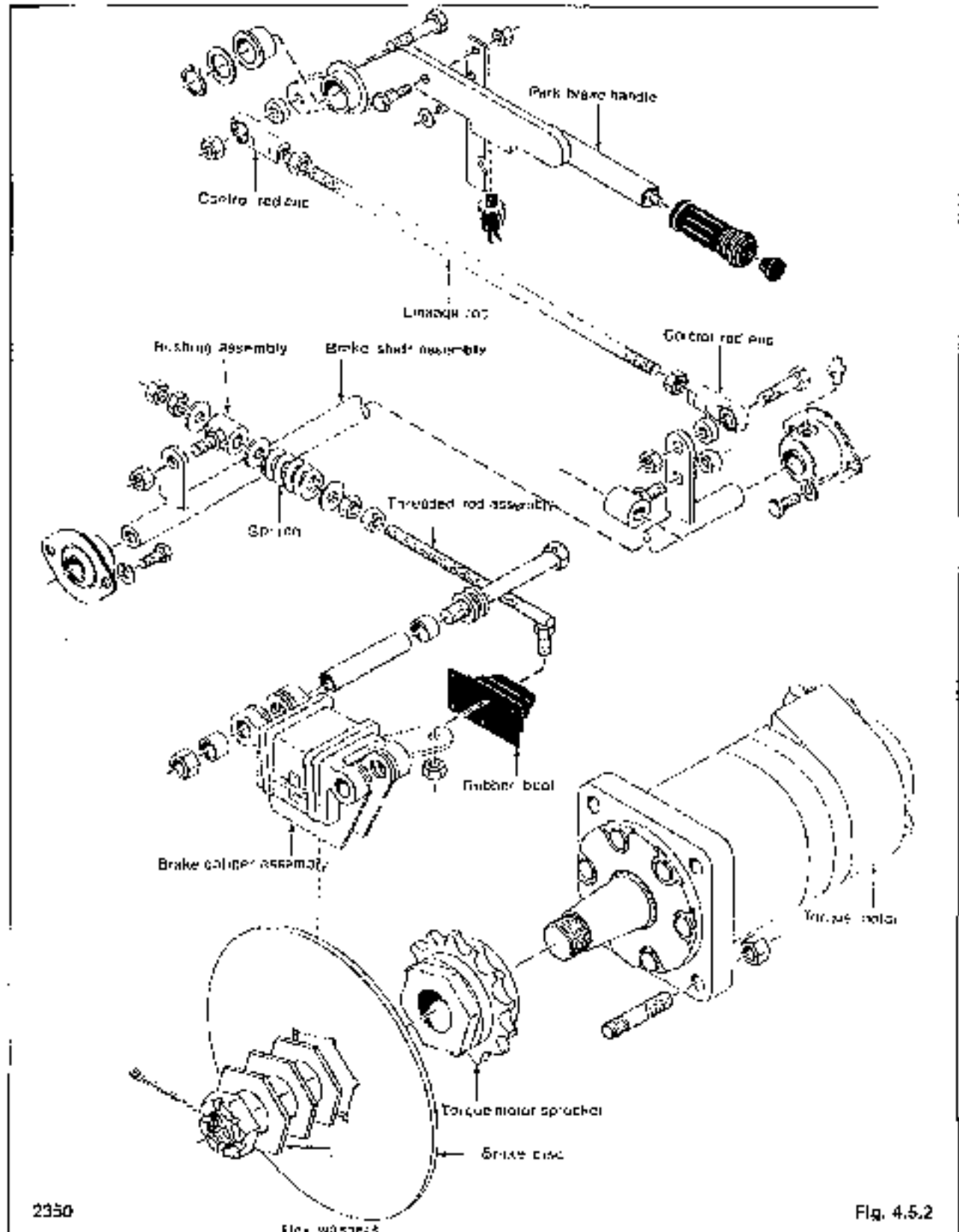
To engage the brakes; pull upward on the brake handle until it locks in position (Fig. 4.5.1).

To release the brakes; push the brake release button (Fig. 4.5.1), lift up on the brake handle until the lock disengages and lower the brake handle completely down.



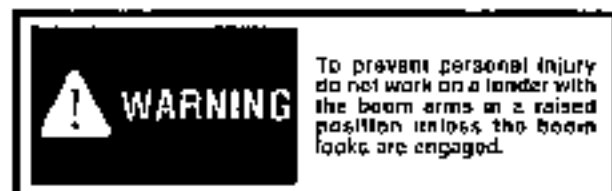
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4.5.2 Brake Installation and Adjustment

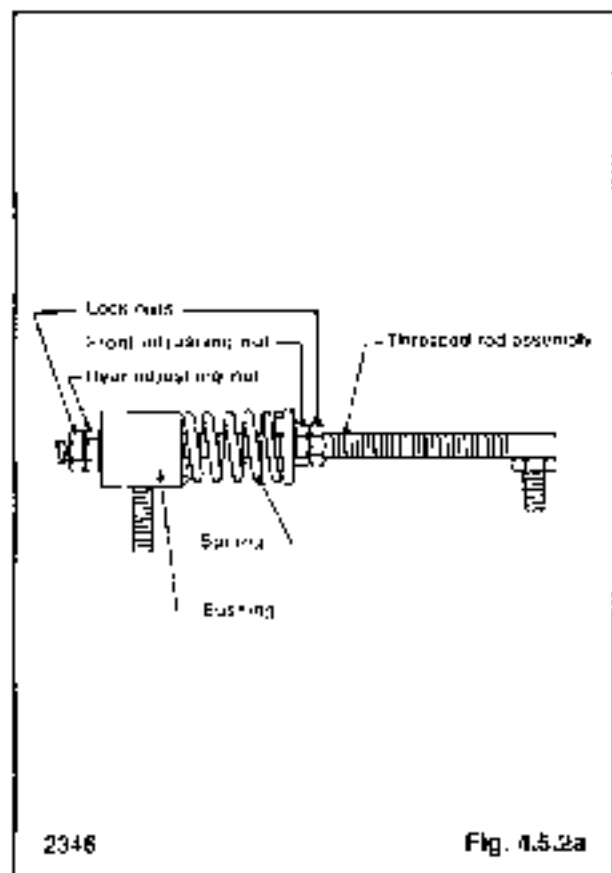


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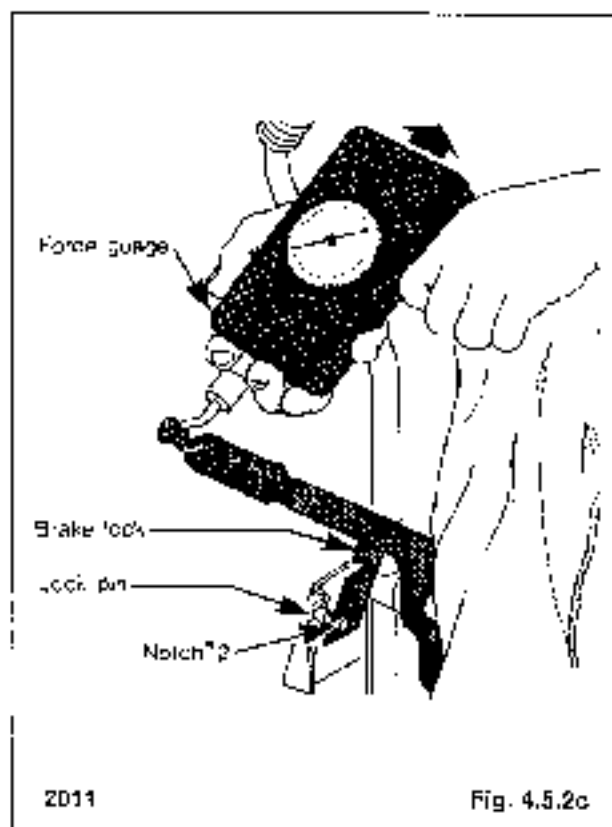
4.5.2 Adjustment:



1. Remove any attachment, raise the boom arms and engage the boom lock. Shut off the engine.
2. Raise the seat and remove the hydrostatic shield.
3. Block the loader securely with all four wheels clear of the ground.



4. Raise brake handle to engage brake. Effort on the handle grip to lock the brake handle notch should be 75-80 lbs. pull. Adjust the nuts on the threaded rod assembly to evenly apply brake pressure until the effort of 75-80 lbs. is achieved (Fig. 4.5.2a).
5. Release brake and allow handle to drop to lowest position. Adjust the other two 3/8" UNC nuts to ensure that no tension is applied to the brake pads when the lever is in the down position (Fig. 4.5.2a).



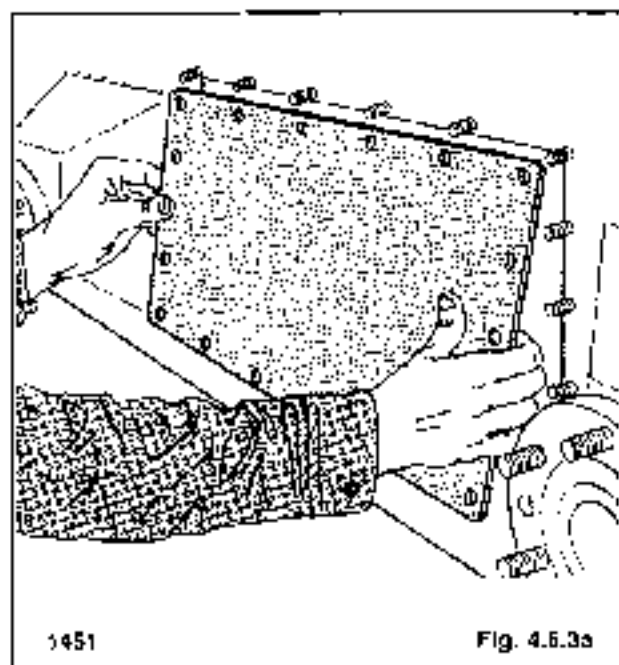
If the handle effort is within the above specifications and the brakes do not perform correctly check the brake pads and disc for wear or damage. If necessary replace. Refer to section 4.5.3-4.5.4.

4.5.3 Parking Brake Caliper and Pad Removal



1. Remove any attachment, raise the boom arms and engage the boom lock. Shut off the engine.
2. Raise the seat and remove the hydrostatic shield.
3. Block the loader securely with all four wheels clear of the ground.
4. Remove the wheels. On reassembly torque the wheel nuts 100-110 ft. lbs. (136-145 N.M.).
5. Remove the final drive inspection cover (Fig. 4.5.3a) located between the axes on the final drive housing. On reassembly apply silicon to the inspection cover to prevent leakage of the drive lubricating oil.

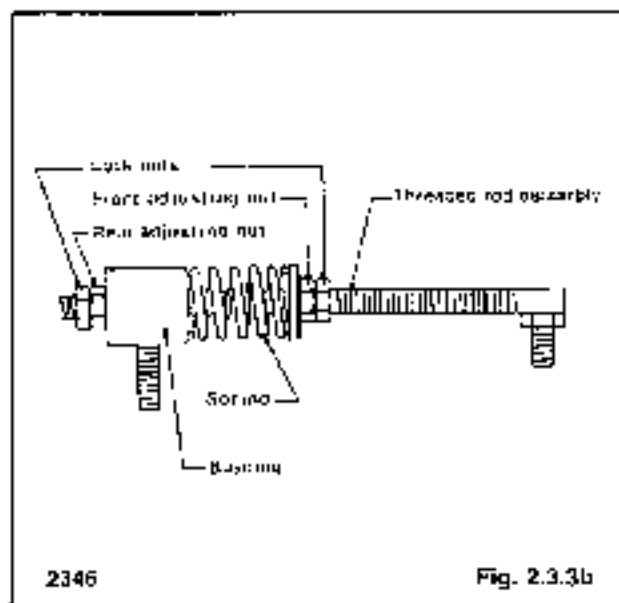
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Fig. 4.5.3a

6. Remove bolt end of threaded rod assembly from brake lever on caliper (Fig. 2.3.3b).



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Fig. 2.3.3b

7. Loosen brake caliper assembly.
8. Remove stainless steel "Z" pin and hex washers from torque motor sprocket.
9. Spread the brake pads apart to allow removal of the brake disc.
10. Remove caliper bolts.
11. Remove the caliper assembly and brake parts.

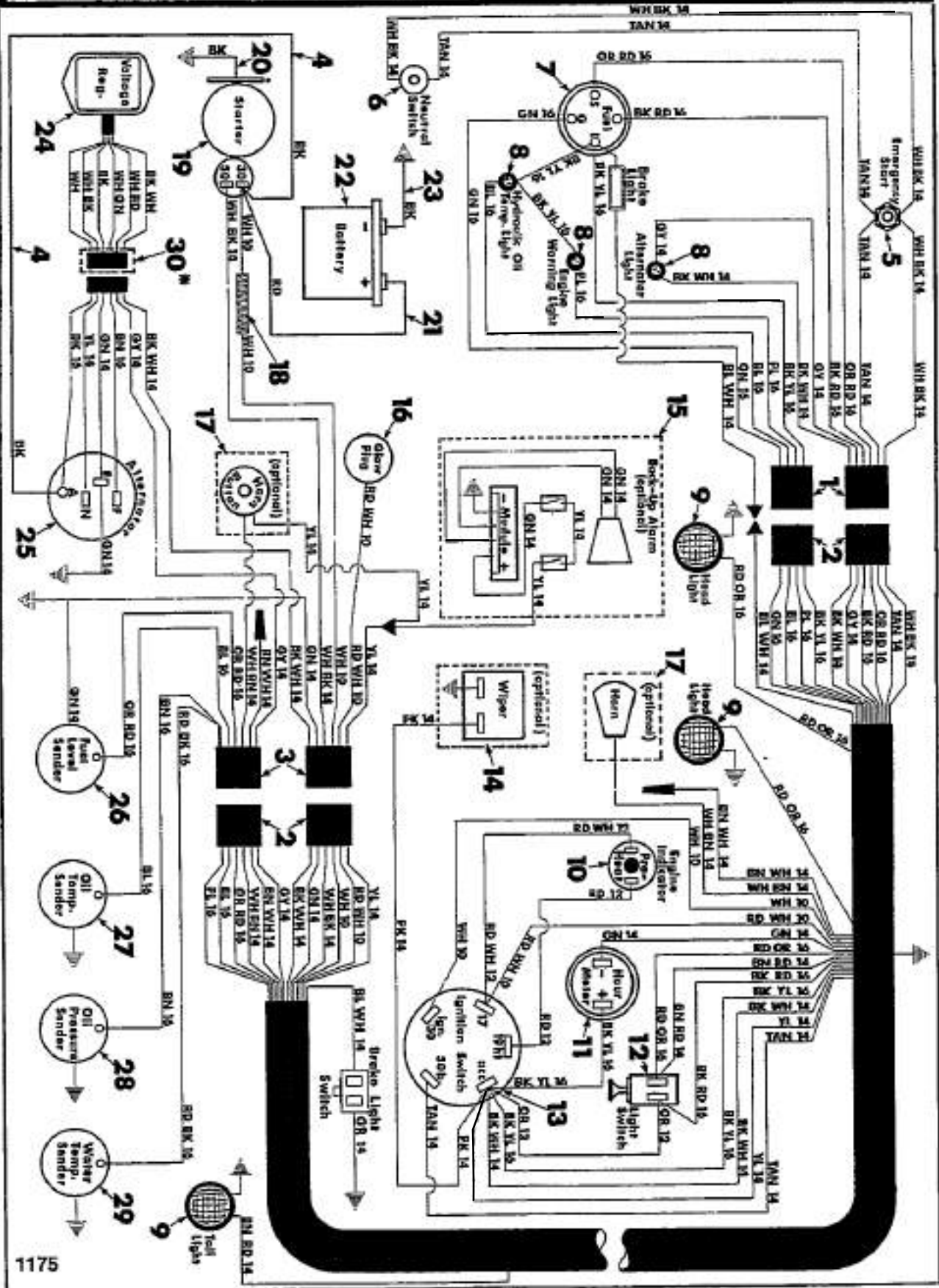
4.5.4 Parking Brake Caliper and Pad Replacement:

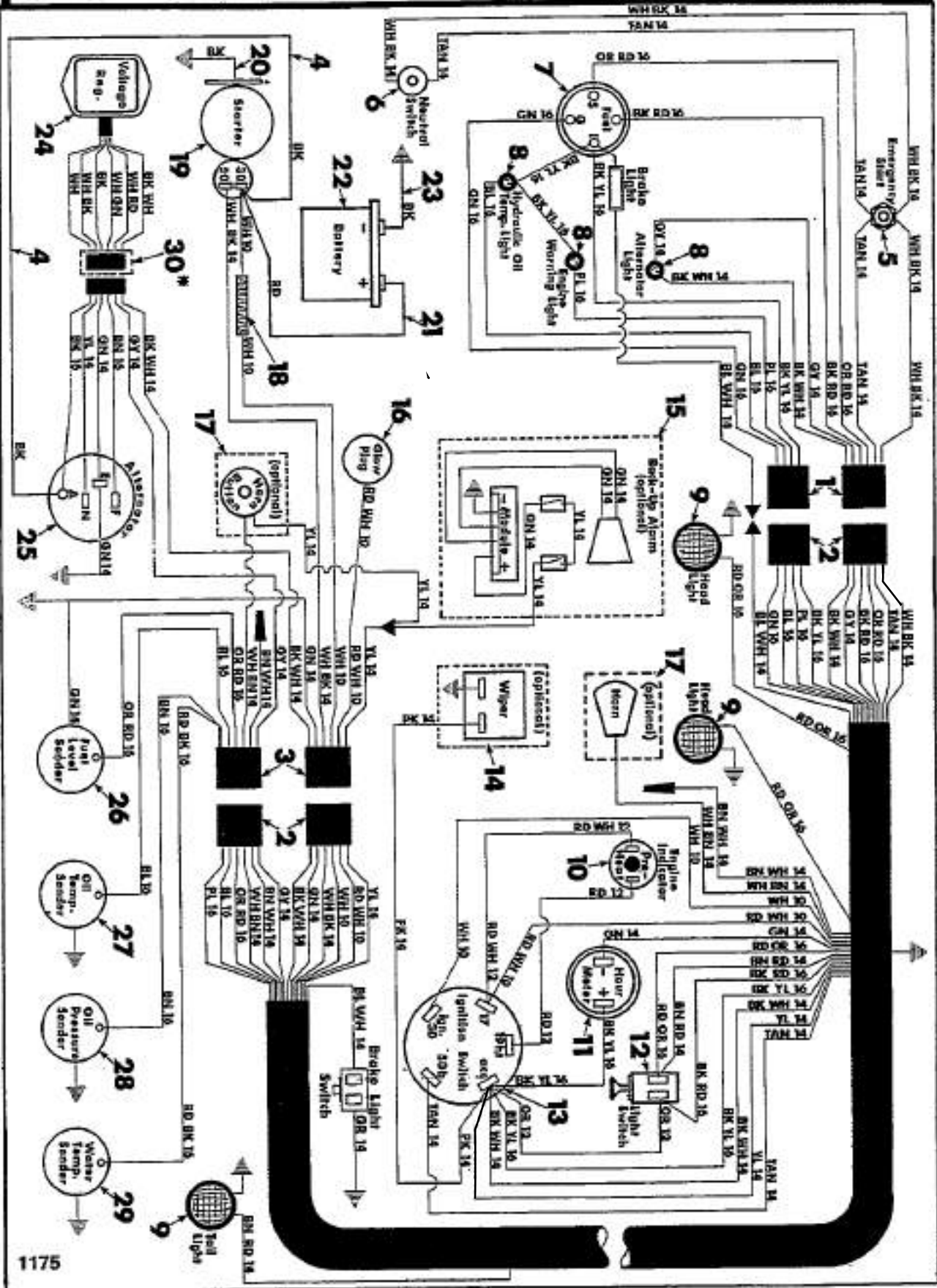
1. Apply silicon around the outside of the brake caliper mounting bolt holes. Insert two 1/2" UNC x 5" long bolts through the holes into both side transmissions.
2. Slide a 1/2" dia. hardened washer onto each of the four bolts on the inside of both transmissions.
3. Install two 3/8" long spacers on the mounting sleeves (one per sleeve) of the brake caliper assemblies and position the brake caliper assemblies onto the two 1/2" UNC x 5" long bolts. The levers will extend through the lever sleeves of the transmission walls.
4. Slide two 1/2" long spacers over the opposite end of the caliper sleeves. Install two 1/2" UNC nylon nuts onto the brake caliper mounting bolts but do not tighten.
5. Spread the brake pads apart on both caliper assemblies to allow you to insert the brake disc between them and onto the torque motor sprocket. The disc must be free to float on the motor sprocket. Once in place, tighten the nylon nuts onto the brake mounting bolts to 95 lbs. ft.
6. Install two 2 1/4" OD x 3/16" thick and one 2 1/4" OD x 1/8" thick hex washers over the hex of the torque motor sprockets. Secure washers and brake discs by inserting the 1/8" dia. x 9 3/4" long stainless steel pin. Bend both ends of each pin over equal length to make a "Z".
7. Remove any parts or dirt from the oval tube through which the brake lever protrudes. Use a good quality cleaner such as "Spot Check cleaner-remover" from Magna Flux Corp. Remove dirt and oil from the protruding portion of the brake levers as well.
8. Stretch rubber boot over brake lever and onto the oval tube. Position boot to remove twisting of the rubber. Caution must be taken to prevent contamination of the inside of the boots with oil and dirt. Put gloves on hands. The chemicals used to seal the boots is an instant bonding adhesive. TAKE CAUTION.
9. Carefully apply one drop of Loctite super-bonder #420 to the line where the boot seals to the lever. Add another drop to where the boot contacts the oval tube. By capillary action the adhesive will wick around the contact areas. Wait one minute then check for adhesion by working the boot and inspecting for gaps and voids. DO NOT ALLOW ADHESIVE TO TOUCH YOUR SKIN. If this occurs, follow instructions as labeled on product safety sheets.
10. Install brake caliper assembly.
11. Adjust brakes. See section 4.5.2 for procedure.

5 ELECTRICAL

NOTE: FOR COMPLETE ENGINE SERVICE AND REPAIR PROCEDURES REFER TO THE KUBOTA WORKSHOP MANUAL

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Hydraulic oil temp. light	5.2.3
Engine warning light (P) temp. low pressure) ..	5.2.4
Hour meter	5.2.5
Glow plugs and indicator	5.2.6
Light switch	5.2.7
Key switch	5.2.8
Over-ride starting switch	5.2.9
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Removal and inspection	5.3.2
Testing and maintenance	5.3.3
Jump starting	5.3.4
STARTING SYSTEM	5.4
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Circuit breaker	5.4.3
TROUBLE SHOOTING	5.5





5.1.2 Specifications:

FANBELT	T1B3HD	T233HD
Belt sag under load of 13.2 to 15.4 lb. (6 to 7 kg)	0.2756 to 0.3543 in. (7 to 9 mm)	

ALTERNATOR

Output current:	35 A/14 V/4000 RPM	25 A/14 V/4000 RPM
Total resistance of rotor coil, measured between terminal "F" and "E"	(std.)	6 Ω
	(max.)	10 Ω
Brush length	(std.)	15.5 mm (0.6102 in.)
	(min.)	10.3 mm (0.4055 in.)

REGULATOR

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 Ω
	"IG" and "F" with contacts	Approx. 11 Ω
"L" and "E" with open contacts	0 Ω	
"L" and "E" with contacts	Approx. 103 Ω	
"N" and "E"	Approx. 23 Ω	
"B" and "E" with open contacts	∞ (infinity)	
"B" and "L" with contacts	0 Ω	
Point gap	0.0118 to 0.0177 in. (0.3 to 0.45 mm)	

STARTER MOTOR

No-load test:	Current	90 A or less
	Voltage	11.5 V
	Speed	3500 RPM or more
O.C. of commutator	(std.)	1.1811 in. (30.0 mm)
	(min.)	1.1417 in. (29.0 mm)
Mica undercutting	(std.)	0.0157 to 0.0354 in. (0.5 to 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	1.0-1.2 Ω
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BATTERY

Voltage	12 V
BCI group size	30 H
Amp. hr. capacity	165
0°F (-17.8°C) cranking amps	520
Ground polarity	Req.

5.2 INSTRUMENTATION

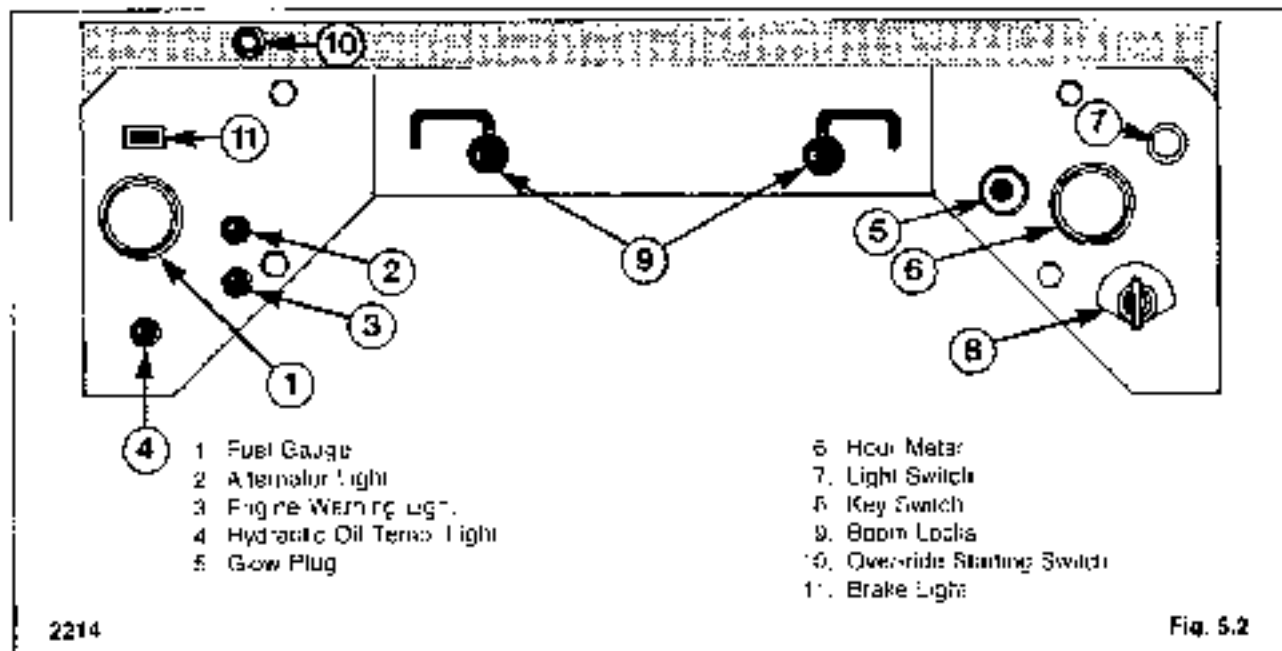


Fig. 5.2

5.2.1 Fuel Gauge:

OPERATION

The fuel gauge indicates the quantity of fuel in the fuel tank (Fig. 5.2). The fuel tank capacity is 18 gal. (60 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 — Engine).

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 — 600 ohm reading — Good fuel sender.

High or low reading — Fuel sender faulty — replace.

Fuel Gauge

2. Remove the left-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.

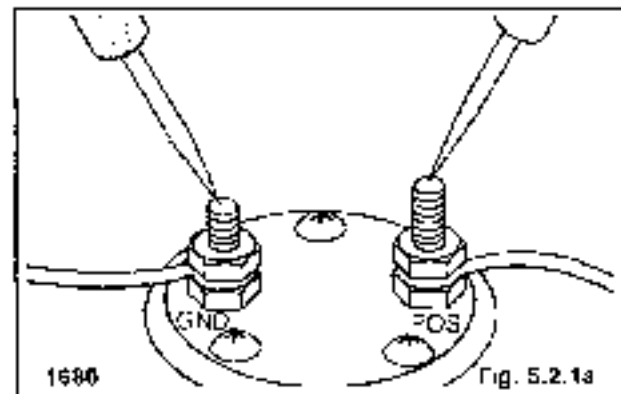


Fig. 5.2.1a

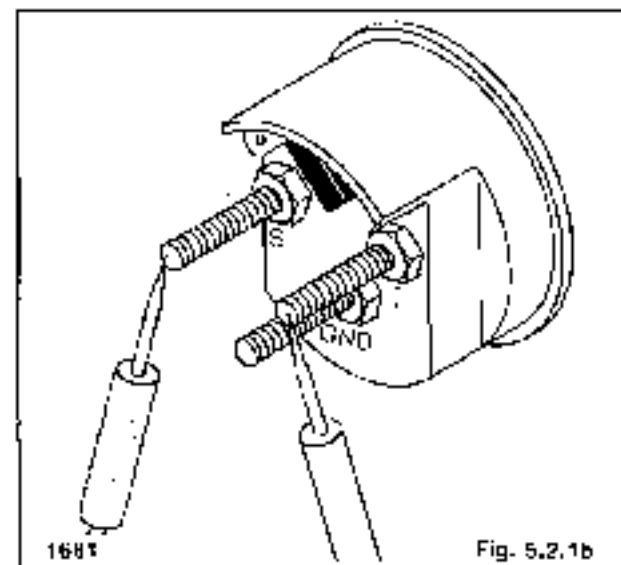


Fig. 5.2.1b

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 clear ground on the frame.

Test Results

50 — 500 ohm reading — Wire to 'S' terminal good.

High or low reading — Faulty wire to 'S' terminal.

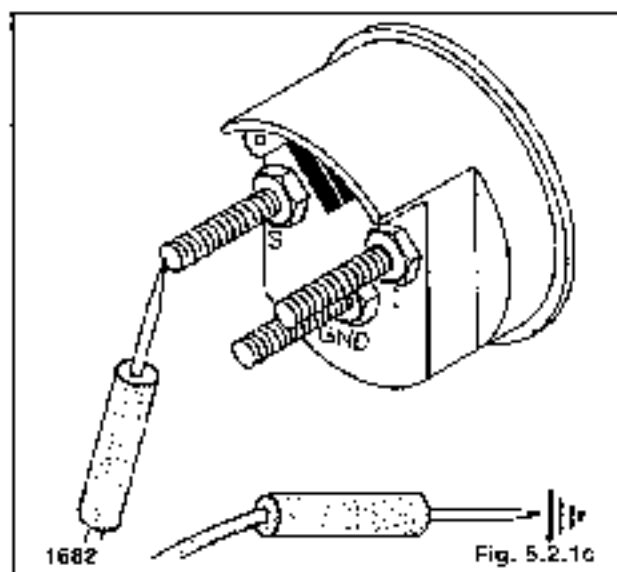


Fig. 5.2.1c

5.2.2 Alternator Light:

The alternator warning light will turn on if the alternator is not producing sufficient current (Fig. 5.2 item 2). With the key switch in the ON position the alternator light will be on. When the engine starts the alternator light will go off. For complete operating description and testing of the charging system refer to engine repair manual.

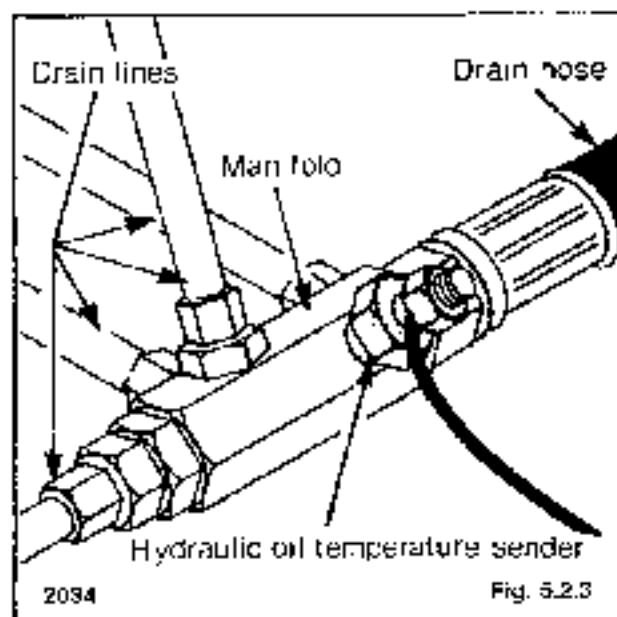


Fig. 5.2.3

5.2.3 Hydraulic Oil Temperature Light:

The hydraulic oil temperature light (Fig. 5.2) measures the temperature of the hydraulic oil. The temperature sender is located in the hydraulic pump and motor drain manifold (Fig. 5.2.3). If the hydraulic oil temperature light comes on during operation shut off the engine and determine the cause of over heating. Check the radiator and hydraulic oil cooler for air flow restriction first before checking for a malfunction of the sender. Refer to section 1.8 and 2.4 for troubleshooting of the hydraulic and hydrostatic systems.

5.2.4 Engine Warning Light (Hi-temp-low pressure) Operation:

The engine warning light serves the dual function of monitoring both the engine oil pressure and engine coolant temperature (Fig. 5.2 item 4).

The engine oil pressure sender switch is located on the R.H. side of the engine. The switch opens under normal oil pressure and closes at low oil pressure illuminating the warning light.

The engine coolant temperature sender switch is located on the L.H. side of the engine.

The coolant temperature switch senses coolant over heating which closes the switch and illuminates the warning light.

If the engine warning light comes on during operation or fails to go out after engine start up, shut-off the engine immediately and determine the cause.

TESTING — OIL PRESSURE SENDER

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 go to test 2. If the light goes out, check the engine oil level before checking for a malfunction of the sender switch or oil pump.

TEST — COOLANT TEMPERATURE SENDER

2. With the engine off, the oil pressure sender switch disconnected, disconnect the wire from the coolant temperature sender. Turn the key switch to the 'ON' position.

Test Results

If the light remains on check for a short in the wiring to the warning light.

If the light goes out check the sender switch for malfunction. Also refer to section 7 — Engine trouble shooting.

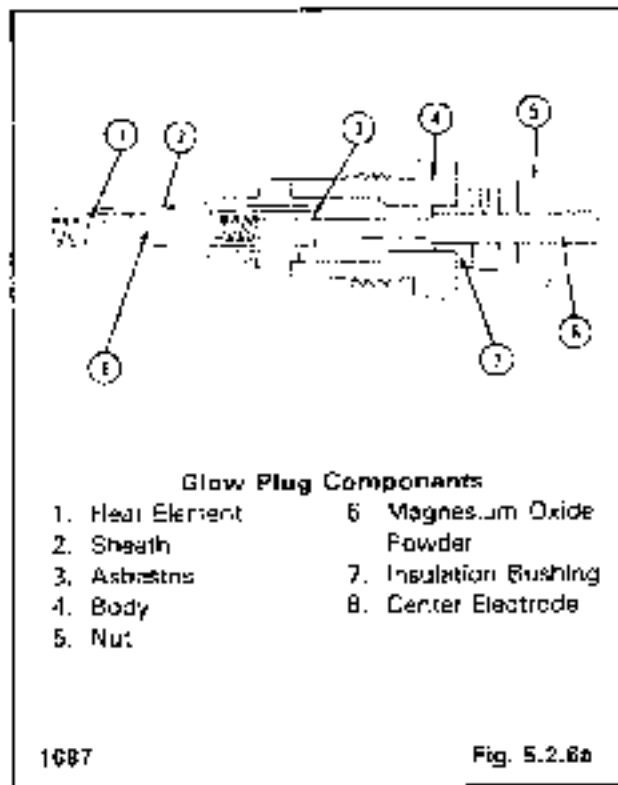
5.2.5 Hour Meter:

The hour meter records the number of engine operating hours and has a total read out of 9999.9 hours (Fig. 5.2 item b). The meter winds approximately every 12 seconds and will run a short time after the ignition has been shut-off.

5.2.6 Glow Plugs and Indicator:

OPERATION

To assist engine starting in cold weather, each cylinder has a glow plug threaded into the pre combustion chamber. The glow plug is a resistance type heating element that will generate heat when electrical current flows through the glow plug to ground. The heating element, Fig. 5.2.5a, is enclosed in a stainless steel sheath filled with magnesium oxide powder. One end of the element is welded to the sheath, which acts as a circuit ground, while the other is welded to the center electrode



Rotating the key switch counterclockwise in the "heat" position closes the glow plug circuit and battery current flows through the glow plug heating element. The heat generated by the glow plug element pre-heats the air in the cylinder making it easier for the fuel injected into the cylinder to vaporize and ignite. An indicator on the instrument panel, Fig 5.2, will glow red when the air in the cylinder has heated to the correct temperature

IMPORTANT

Do not disassemble glow plugs. Plugs are sealed and cannot be removed.

IMPORTANT

Never use ether starting fluid in conjunction with the use of the glow plugs as severe damage to the engine may occur.

TESTING

TEST 1 — Glow Plug Connector:

Before performing any tests on the glow plug circuit disconnect the negative or ground cable from the battery.

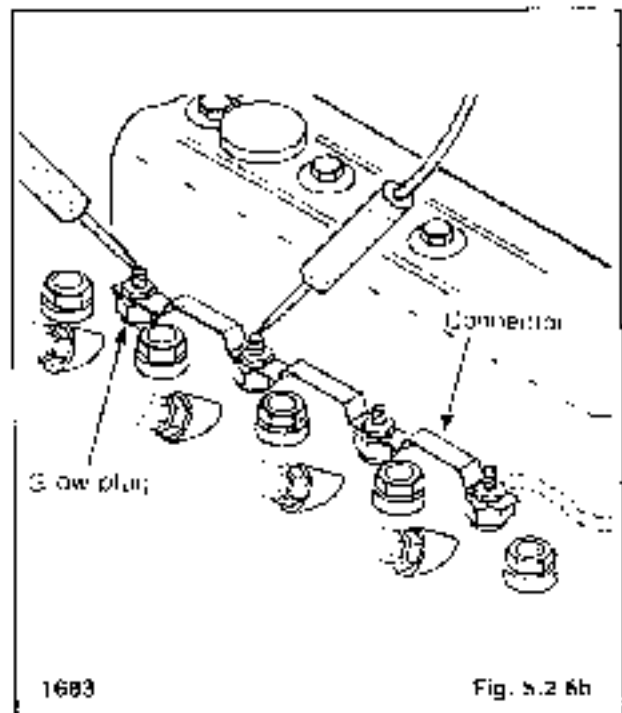
With the key switch off, connect one ohmmeter lead to the first glow plug nut (Fig. 5.2.6b). Connect the other ohmmeter lead to the second glow plug nut.

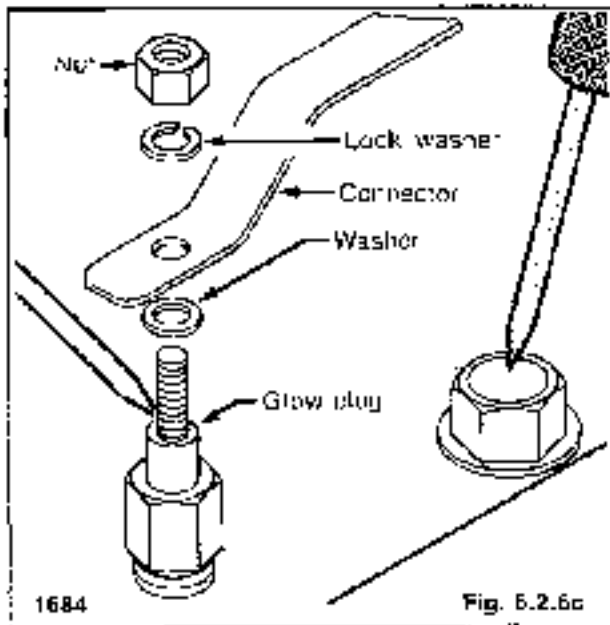
Test Results

Low or zero ohms = Good continuity

High resistance = Bad connection — remove connector and clean.

Continue and check continuity between all 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 (Fig. 5.2.6c). Connect the other ohmmeter lead to a clean ground. Check each glow plug.

Test Results

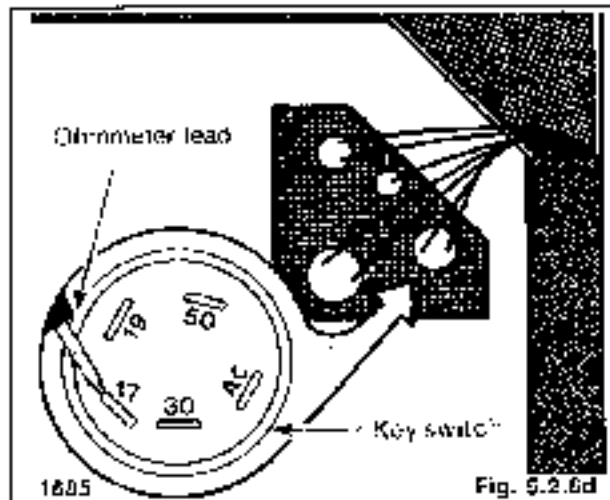
- 1.73 — 1.5 ohm reading = Good glow plug
- T233 1.0 — 2 ohm reading = Good glow plug
- Infinite or zero reading = Faulty glow plug — replace

TEST 3 — Key Switch to Glow Plug:

Remove the bolts securing the R.I. instrument panel to the frame. With the key switch off, connect one ohmmeter lead to the key switch at terminal number 17 (Fig. 5.2.6d). Connect the other ohmmeter lead to the glow plug with the wire terminal (Fig. 5.2.6e).

Test Results

- Low to zero reading = Good continuity.
- High reading = Faulty wire from switch to glow plug — replace

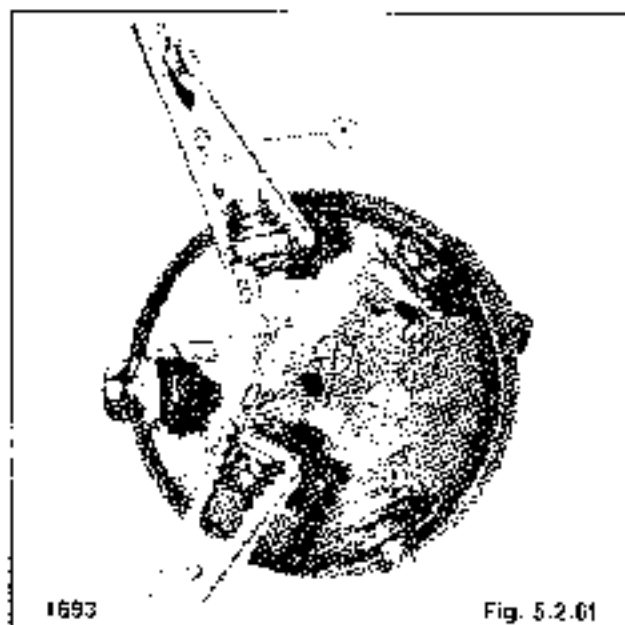
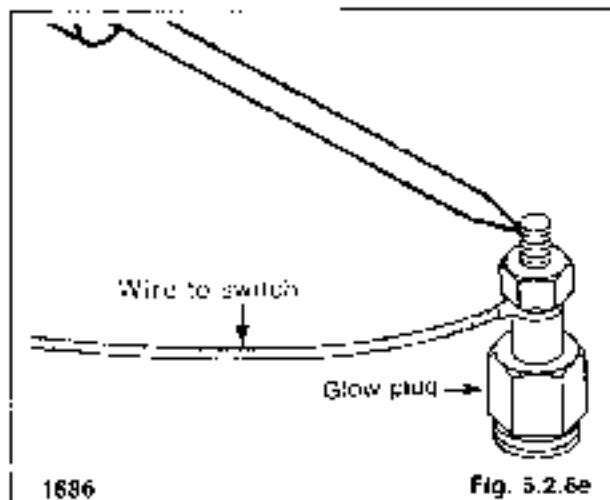


TEST 4 — Key Switch - Heat Position Check:

Connect one ohmmeter lead to the terminal marked 19 on the key switch (Fig. 5.2.6i). Connect the other ohmmeter lead to the terminal marked 30 on the key switch. Rotate the key counter-clockwise 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:

(A) Connect one ohmmeter lead to the terminal marked 19 on the key switch (Fig. 5.2.6g). Connect the other ohmmeter lead to terminal on the glow plug indicator.

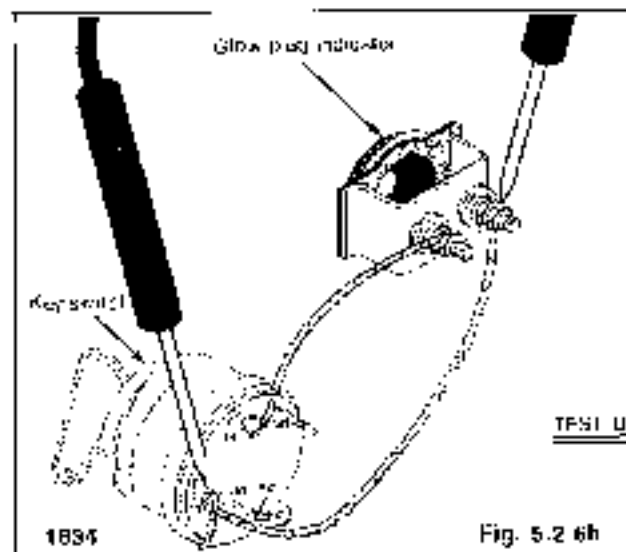
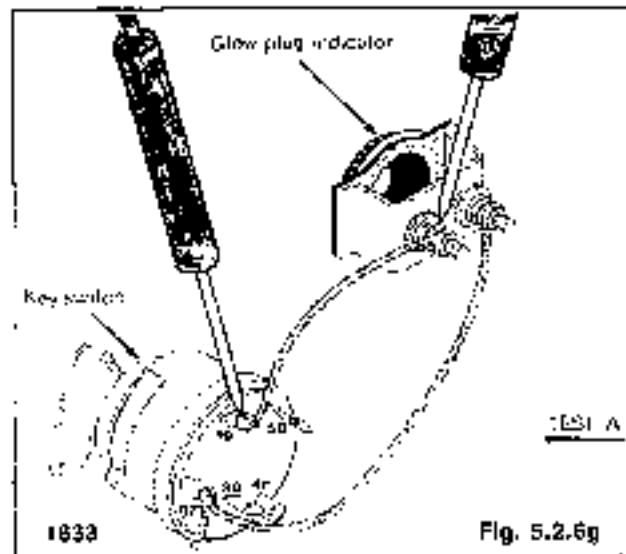
Test Results

Low or zero reading = Good continuity
High reading = Faulty wire — replace.

(B) Connect one ohmmeter lead to the terminal marked 17 on the key switch (Fig. 5.2.6h). Connect the other ohmmeter lead to terminal on the glow plug indicator.

Test Results

Low or zero reading = Good continuity
High reading = Faulty wire — replace.

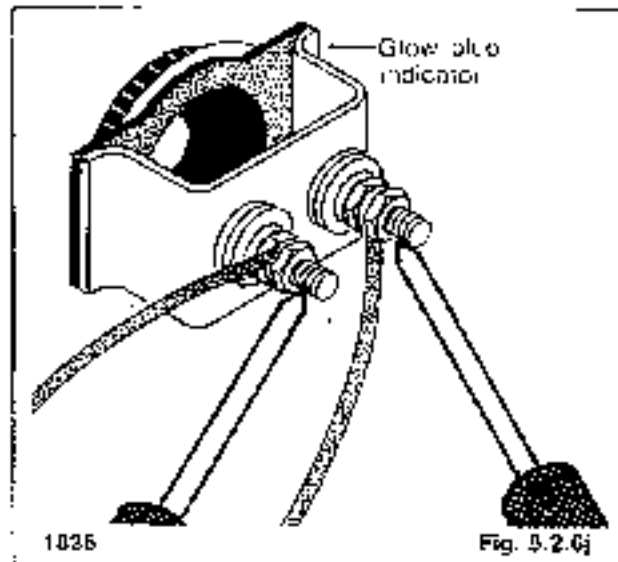


TEST 6 — Glow Plug Indicator:

Connect one ohmmeter lead to each of the glow plug indicator terminals (Fig. 5.2.6j).

Test Results

Low or zero reading = Good indicator.
High reading = Faulty indicator — replace.



5.2.7 Light Switch:

The light switch (Fig. 5.2) is an on-off switch. Pulling the switch out will turn on the headlights, rear work light and instrument panel lights. Pushing the switch in will start the lights off.

5.2.8 Key Switch:

The key switch (Fig. 5.2) is a four position switch, off, preheat (diesel only), on and start. Turning the key counter-clockwise will engage the engine preheater or glow plugs. To engage the starter turn the key clockwise. When the key is released, it will return to the on position.

TESTING

Before performing any tests on the key switch disconnect the negative or ground wire from the battery.

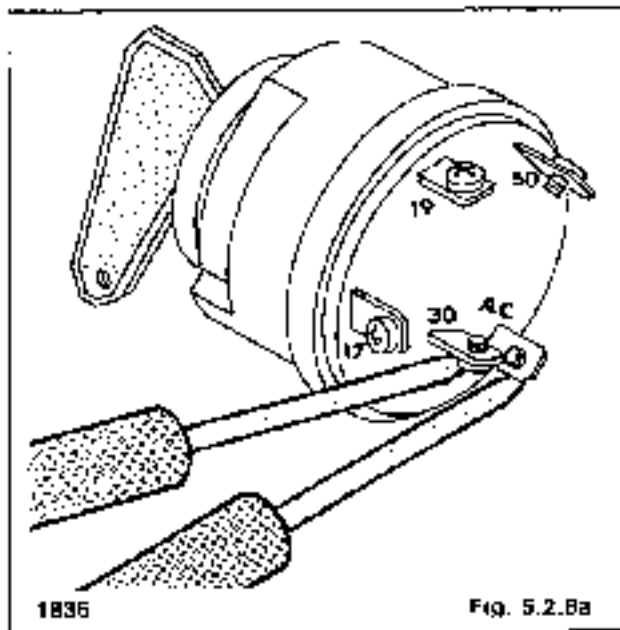
Remove the bolts which secure the R.H. Instrument panel to the BOPS.

TEST 1 — "On" Position:

Connect the ohmmeter leads across the key switch terminals marked 30 and 4C (Fig. 5.2.6a). Turn the switch to the "ON" position.

Test Results

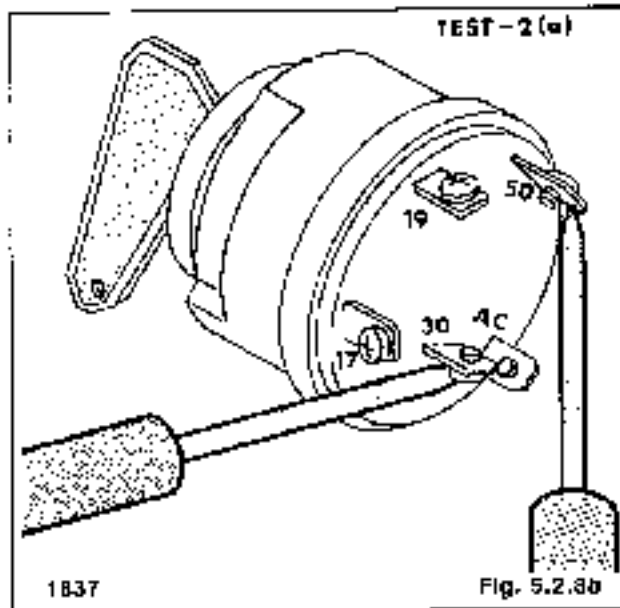
Low resistance reading = Good.
High resistance reading = Faulty switch — replace.



TEST 2 — "Start" Position:

(A) Connect the ohmmeter leads between the terminals marked 30 and 50 on the key switch (Fig. 5.2.8b).

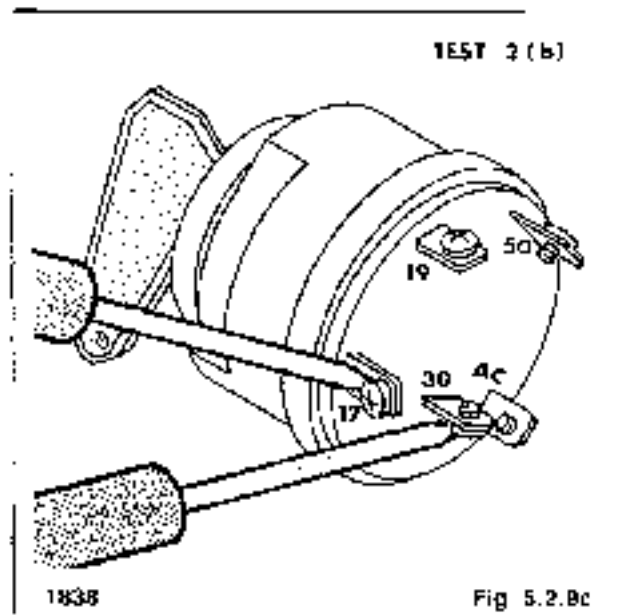
Turn the switch to the "Start" position and observe the ohmmeter reading.



(B) Connect the ohmmeter leads between the terminals marked 30 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.

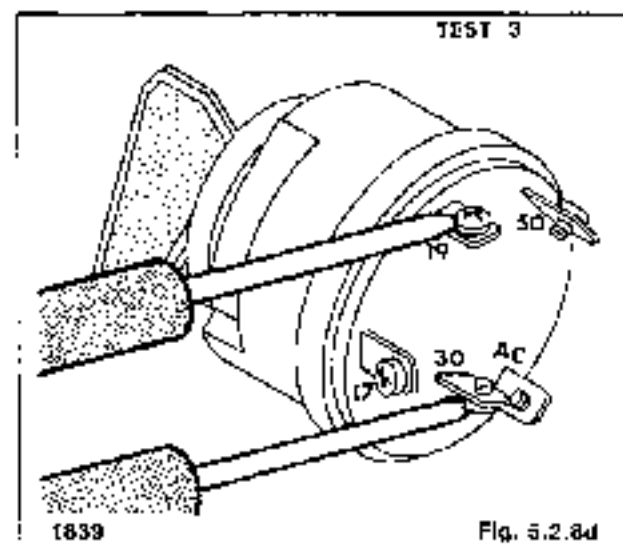


TEST 3 — "Heat" Position:

Connect the ohmmeter leads between the terminals marked 30 and 10 on the key switch (Fig. 5.2.8d).

Turn the switch to the "Heat" position and observe the ohmmeter reading.

Test Results
 Low resistance reading = Good.
 High resistance reading = Faulty switch — replace.



5.2.9 Over-Ride Starting Switch:

The loader starting circuit is designed so that the engine cannot be started unless the seat bar is in the up position, the steering control levers centered in neutral and the foot pedals locked.

The loader is also equipped with an over-ride start switch for use in situations such as the engine stalling.

To restart the engine using the over-ride switch, press the switch (Fig. 5.2.9A) and turn the ignition to start position. When the engine has started, release the over-ride switch.

The over-ride switch must not be used for normal starting.



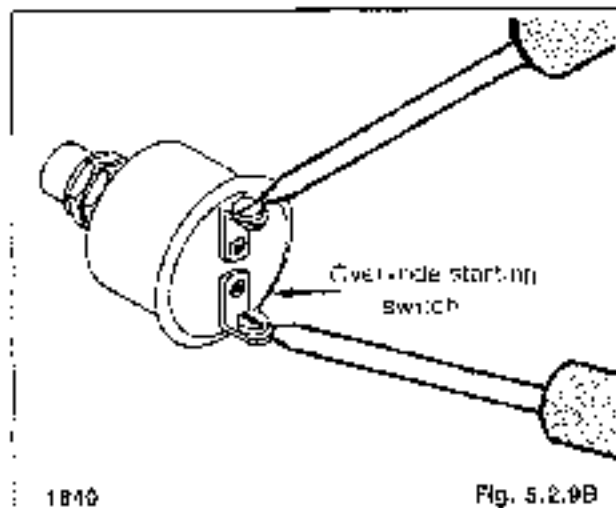
TESTING — OVER-RIDE STARTING SWITCH

Connect one ohmmeter lead to one of the terminals on the over-ride switch (Fig. 5.2.9B). Connect the other ohmmeter lead to the other terminal on the switch. Depress the button.

Test Results

Low resistance reading = Good switch.

High resistance reading = Faulty switch — replace.



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 acid contacts the eyes, wash immediately with much clean water and get medical attention. Wear rubber gloves and protective clothing to keep acid off the skin. If acid contacts the skin, wash off immediately with clean water.

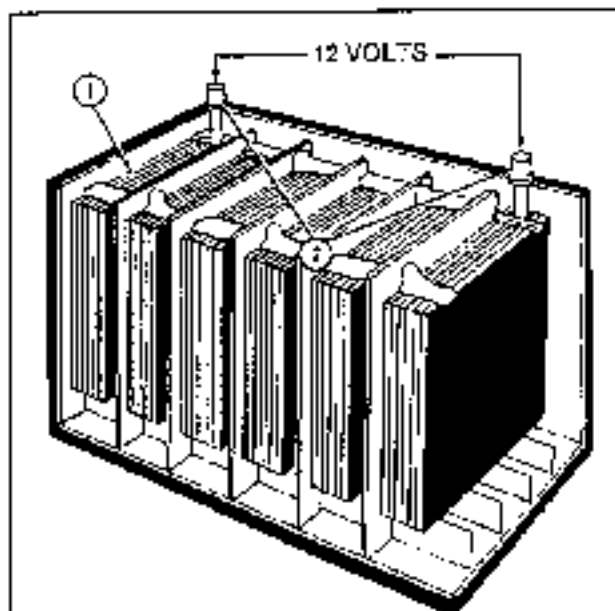
1. When mixing battery electrolyte, it is important to pour the concentrated acid into the water and not the water into the acid.
2. When working with acid, such as filling batteries, splash-proof goggles should be worn. (Additional protective clothing may be advisable if many batteries are handled.)
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 155 ampere-hours and is negatively grounded. The battery is constructed with six lead acid cells connected in series. Each cell contains positive and negative plates placed alternately next to each other and separated from each other by a plastic 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 positive and negative terminal post.

When the battery cells are submerged in a liquid electrolyte solution of sulphuric acid, Fig. 5.3.2B, the acid and water combines chemically with the lead peroxide on the positive plate and with the sponge lead on the negative plate causing a transfer of electrons between plates. One plate will lose electrons and become positively charged while the other plate will gain electrons and become negatively charged. When the battery is connected to a load 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.



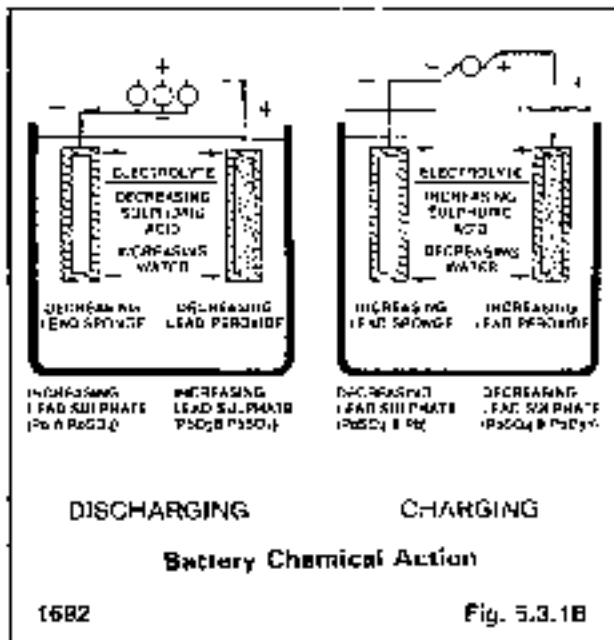
Battery Construction

- 1. Battery Cells
- 2. Terminal Posts

1591

Fig. 5.3.1A

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.



1592

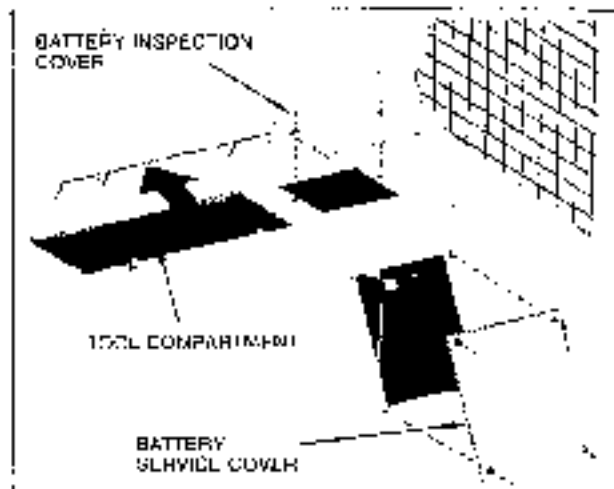
Fig. 5.3.1B

5.3.2 Battery Removal and Inspection:

The battery is located in the ROPS behind the operator's seat. A battery inspection cover is located at the top of the battery compartment (Fig. 5.3.2a).

Remove the battery as follows:

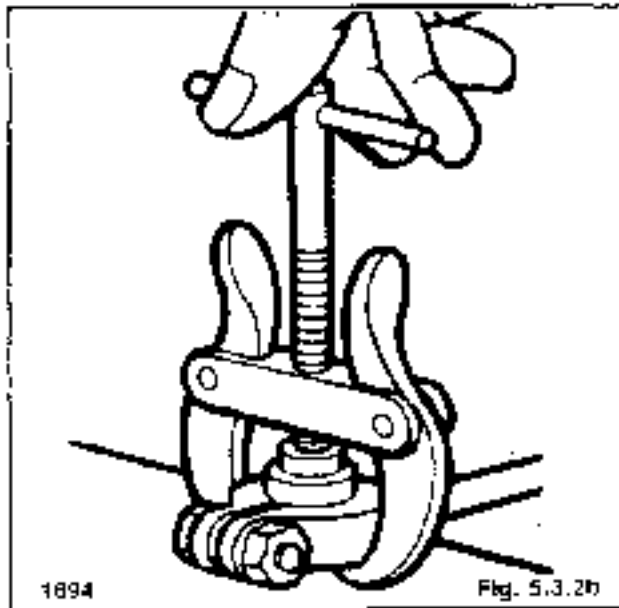
- 1 Remove the seat and the battery service cover (Fig. 5.3.2a).



1115

Fig. 5.3.2a

2. Open the tool compartment and disconnect the ground wire where it attaches to the frame.
3. Remove the battery hold down strap and slide the battery out of the battery compartment.
4. Use a puller to remove the negative (ground) cable from the battery (Fig. 5.3.2b). Remove the positive cable from the battery.
5. Remove the battery from the loader.
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 hold-downs 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.

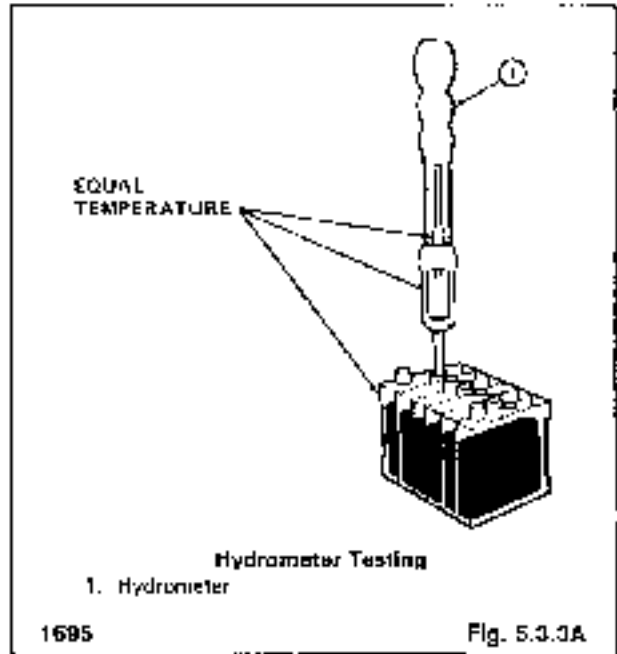


5.3.3 Testing and Maintenance:

SPECIFIC GRAVITY — HYDROMETER TEST

The hydrometer test indicates the battery state of charge by measuring the specific gravity of the electrolyte in the battery cells. The specific gravity will vary according to the amount of unused sulphuric acid remaining in solution. The quantity of sulphuric acid in solution determines the battery state of charge.

The hydrometer used for this test should be equipped with a thermometer and the float scale should be graduated to read from 1.180 to 1.320 in graduations of .005 specific gravity. The graduated marking should be accurate within .002 (Fig. 5.3.3A).

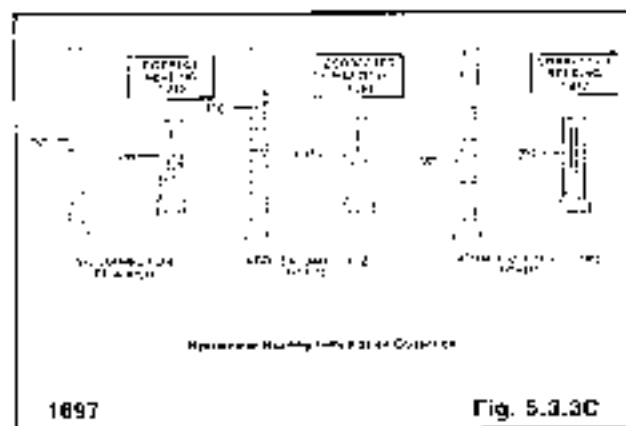
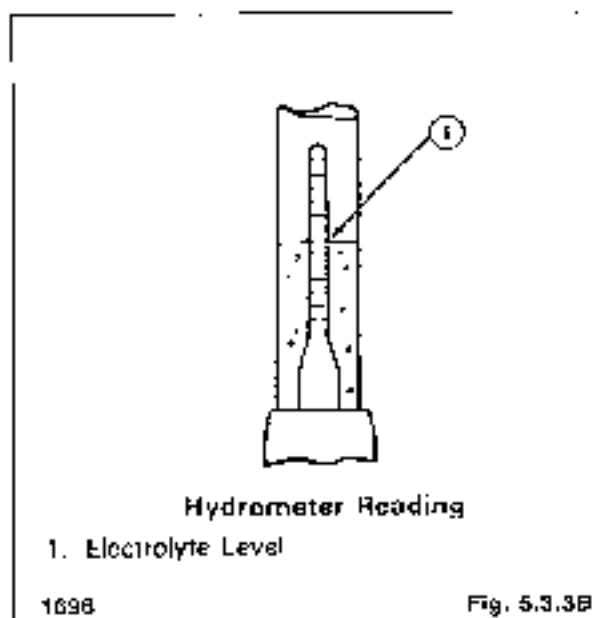


1. Check the electrolyte level in each cell. Add water to any low cells and charge the battery for ten minutes at twenty amperes to mix the water with the electrolyte.
2. Draw electrolyte in and out of the hydrometer barrel to equalize the temperature of the float and thermometer to that of the acid in the cell (Fig. 5.3.3A).
3. Draw in enough electrolyte to raise the float in the barrel with the bulb fully floating. Do not draw in so much electrolyte that the float is forced against the top of the barrel.
4. With the hydrometer at eye level, read the float scale at the electrolyte level. Hold the hydrometer straight so that the float does not stick to the side of the barrel (Fig. 5.3.3B).
5. Read the specific gravity of each cell.
6. Correct the specific gravity reading for temperature variations (Fig. 5.3.3C).
 - a. Add .004 points for each 10° above 80°F.
 - b. Subtract .004 points for each 10° below 80°F.

Test Results

1. If the average specific gravity of all cells is above 1.225, but the variation between cells is more than 50 points (.050), the battery is unserviceable. Remove the battery for further testing.

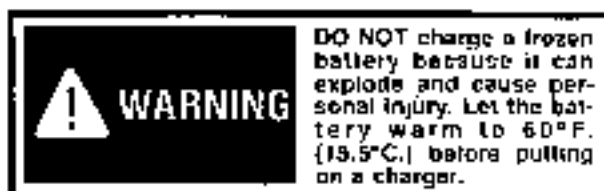
2. If the average specific gravity of one or more cells is less than 1.225, recharge the battery.
3. At the end of the charge period, if the cell variation is more than 50 points (0.050), replace the battery.
4. When the specific gravity of a cell is above 1.225 and variation between cells is less than 50 points, the battery may be tested under load.



CHARGING

The maintenance free battery used in the loader should be slow charged only.

There are many types of battery charging equipment available. Be sure to follow the instructions of the equipment manufacturer for the necessary preparations and precautions. However, the following items should be observed when slow-charging the battery with any type of equipment.



1. If the battery is to remain in the vehicle, disconnect the cables at the battery, to prevent damage to the electrical system during charging.
2. Thoroughly clean the battery.
3. Make sure the electrolyte is at the proper level.
4. The battery is to be charged at a rate of seven amps.
5. Battery electrolyte temperature must never exceed 125°F (52°C.). If this temperature is reached, the battery should be cooled by reducing the charge rate or by disconnecting the battery from the charger.

The average length of time necessary to charge a battery by the slow-charge method at the indicated rates is from 12-16 hours, however, when a battery continues to show an increase in specific gravity, battery charge should be continued even if it takes 24 hours or more.

A battery is in a maximum charged condition when all cells are gassing freely and three corrected specific gravity readings, taken at hourly intervals, indicate no increase in specific gravity.

CAPACITY TEST

The capacity test is performed to determine if the battery has a discharge capability sufficient to meet the high current demands of the starter motor. The battery is connected to a carbon pile rheostat which can duplicate the high discharge rate the battery experiences during engine cranking. While connected to the simulated load for fifteen seconds the battery must maintain a voltage of 9.6 volts. To obtain satisfactory results the capacity test should be performed only on a battery which is 100% charged. Never perform this test on a battery which is less than 75% charged (1.230 specific gravity).

1. Connect a carbon pile load tester and voltmeter to the battery.
 - a. Make sure the load control knob is in the "OFF" position before making the connection.
 - b. Connect the red leads to the battery positive post and the black leads to the battery negative post.
 - c. Voltmeter leads must contact the battery posts — not the ammeter leads.
2. Turn the tester load control knob until the current draw is equal to 75% of the battery's cold cranking rate.
3. At the end of 15 seconds, observe the voltmeter reading and turn the load control knob to the "OFF" position.

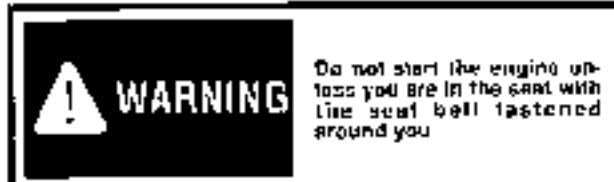
Test Results

Battery must maintain above 9.6 volts for the test period
 9.6 volts or above = Good (serviceable).
 Less than 9.6 volts = Faulty battery — replace.

5.3.4 Jump Starting:

JUMP STARTING

1. Set the parking brake
2. Check the battery condition. Do not attempt to jump start if the battery is damaged, if the electrolyte level is low, or if the electrolyte is frozen.
3. Use only a 12 volt battery with sufficient capacity for jump starting.
4. Check that all electrical switches are off and that the vehicles are not touching one another.
5. Attach the end of one jumper cable to the positive terminal of the booster battery and the other end of the same cable to the positive terminal of the discharged battery.
6. Attach one end of the remaining cable to the negative terminal of the booster battery, and the other end to a solid engine ground at least 12 inches from the battery of the vehicle being started — **DO NOT CONNECT DIRECTLY TO THE NEGATIVE TERMINAL OF THE DEAD BATTERY**
7. Start the engine of the vehicle that is providing the jump start and turn off all electrical switches.
8. Start the engine in the loader with the discharged battery.
9. Reverse these procedural steps exactly when removing the jumper cables. The first cable to be disconnected should be the negative cable from the ground on the loader that was being jump started.



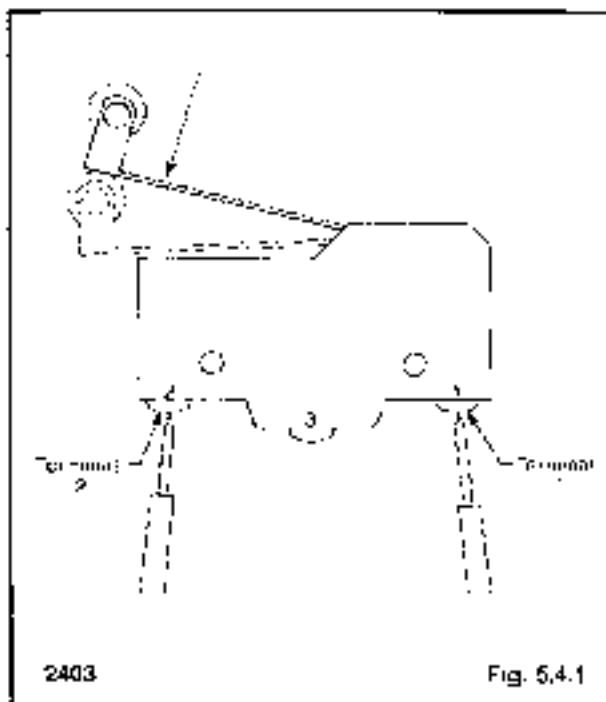
5.4.1 Safety Start Switch:

TESTING

1. Connect one ohmmeter lead to terminal 1 on the safety start switch (Fig. 5.4.1)
2. Connect the other ohmmeter lead to terminal 2 on the safety start switch.

Test Results

High resistance reading = Faulty switch — replace.
 Low resistance reading = Good.



3. With the ohmmeter still connected to the two terminals on the safety start switch (Fig. 5.4.1), depress the lever.

Test Results

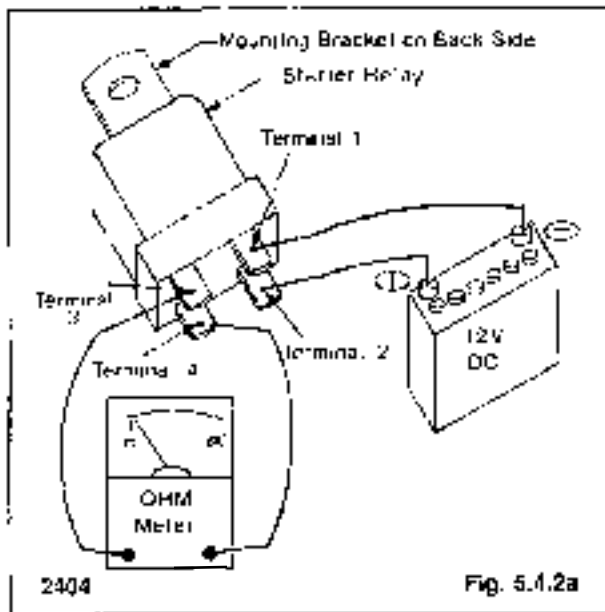
Low resistance reading = Faulty switch — replace.
 High resistance reading = Good.

5.4.2 Starter Relay T183HD:

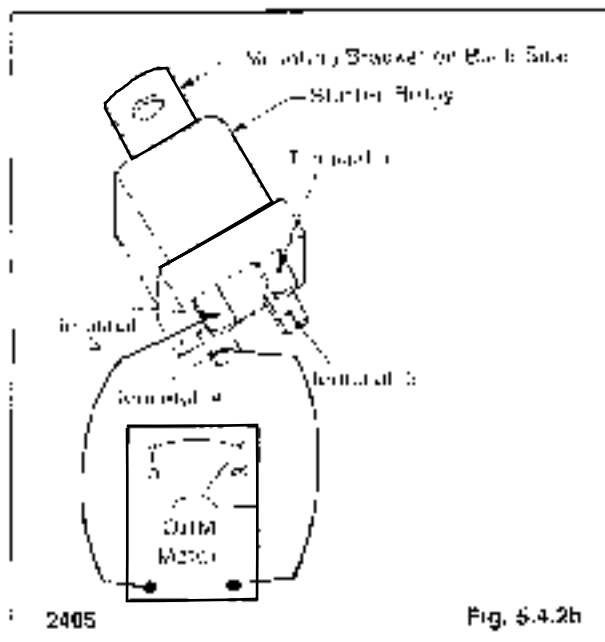
TESTING

1. Remove the starter relay from the loader.

2. Connect a jumper lead from the starter relay 2 terminal to the battery positive (+) terminal (Fig. 5.4.2a).



3. Connect a jumper lead from the starter relay 1 terminal to the battery negative (-) terminal (Fig. 5.4.2a).
4. Measure the resistance with an ohm meter across the starter relay 3 terminal and 4 terminal (Fig. 5.4.2a).
5. If 0 ohm is not indicated, the starter relay is faulty.
6. Disconnect jumper leads from starter relay 1 terminal and 2 terminal (Fig. 5.4.2b).



7. Measure the resistance with an ohmmeter across the starter relay 3 terminal and 4 terminal (Fig. 5.4.2b).
8. If infinity (∞) is not indicated, the starter relay is faulty.

RESISTANCE	Across terminals 3 and 4	when jumper leads are connected (1-2)	0 Ohm
		when jumper lead is disconnected	Infinity

5.4.3 Circuit Breaker.

For circuit protection a circuit breaker is located on the starting circuit (Fig. 5.4.2a).

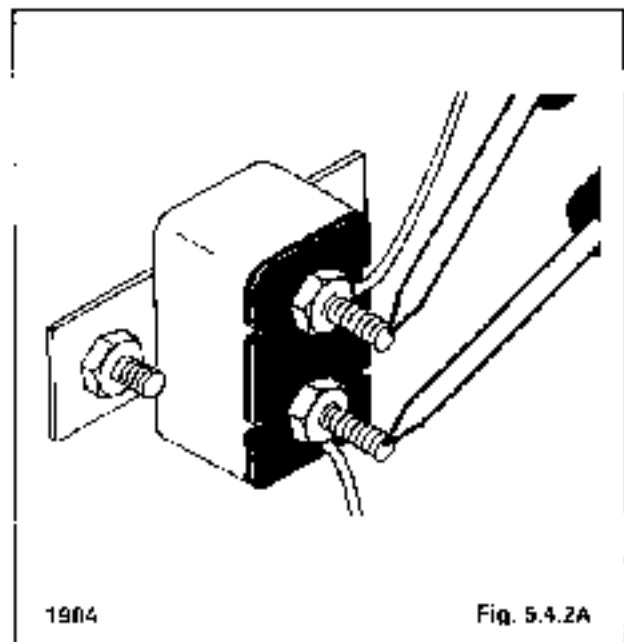
The circuit breaker if tripped will automatically reset
 T183HD 40 AMP.
 T283HD 50 AMP.

TESTING: CIRCUIT BREAKER

1. With the ignition off connect one ohm meter lead to one of the terminals on the circuit breaker (Fig. 5.4.2A).
2. Connect the other ohmmeter lead to the other circuit breaker terminal.

Test Results

- Low resistance reading – Good.
 High resistance reading – Defective circuit breaker - replace.



5.5 TROUBLE SHOOTING

STARTING SYSTEM

Problem	Cause	Conclusive Action	Refer to Section
Starter will not engage	Safety bar down, safety start switch disengaged	Raise safety bar to engage safety start switch. If starter still won't engage check safety start switch.	5.4.1
		Press over-ride starting switch.	5.2.9
	Battery discharged	Check and charge battery or replace.	5.9
	Loose or disconnected wiring	Check and repair.	
	Defective starter solenoid	Check and if necessary replace.	5.2.5
	Defective solenoid	Check and if necessary replace.	
	Defective starter	Check and if necessary replace.	
Starter motor engages but engine does not turn over	Defective starter	Check and if necessary repair or replace.	
	Defective solenoid	Check and if necessary replace.	
Starter motor indicates full speed but will not engage	Defective pinion spring	Replace.	
Starter does not disengage after engine starts	Faulty return switch	Check and if necessary replace.	5.7.3
	Defective solenoid	Check and if necessary replace.	

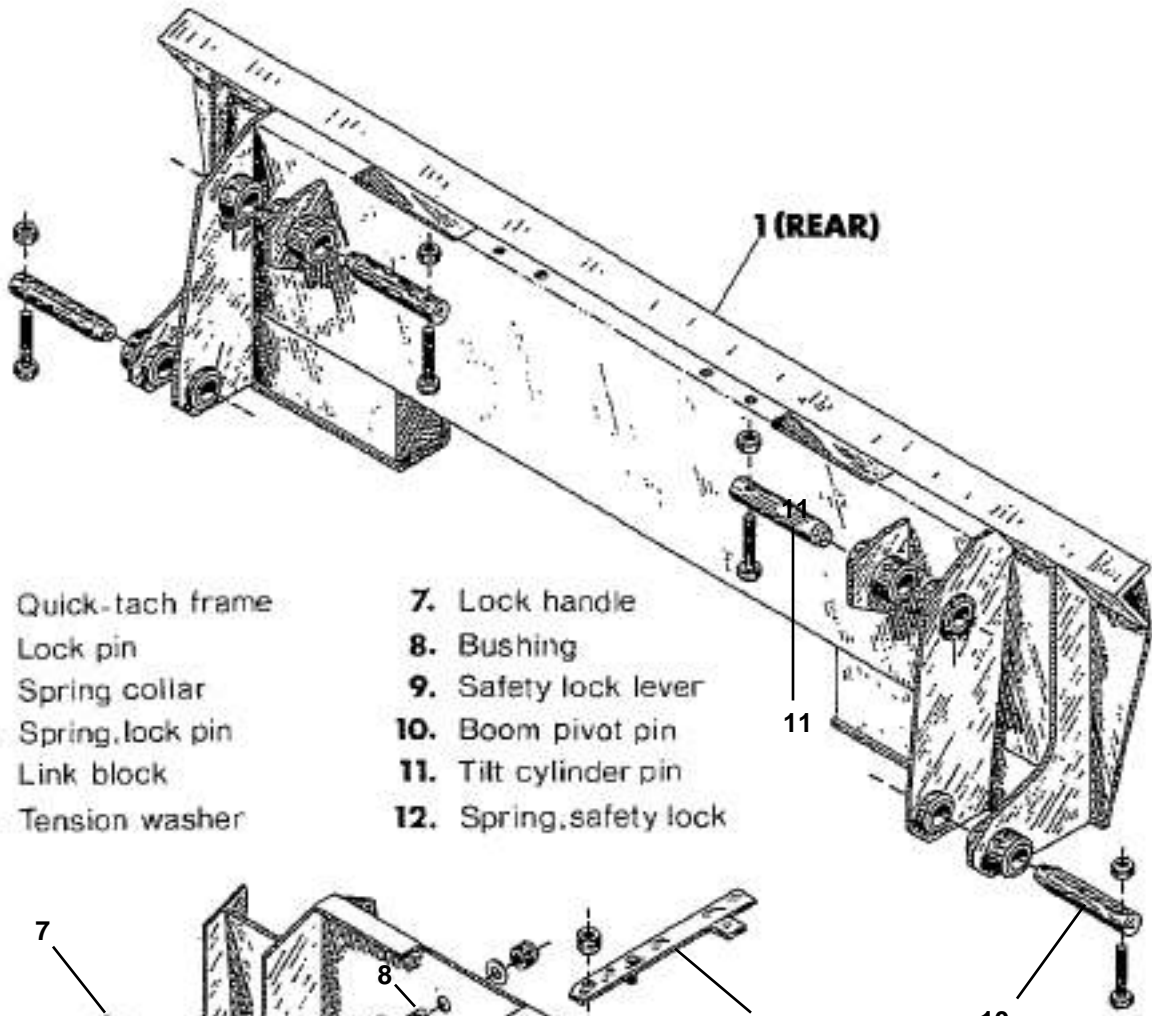
CHARGING SYSTEM

Battery low in charge or discharged	Drive belt slipping	Adjust.	7.3.5
	Defective battery	Check and if necessary replace.	5.9
	Faulty 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 overloads	Defective battery	Check and if necessary replace.	5.9
	Defective voltage regulator	Check and if necessary replace.	
	Defective alternator	Check and if necessary replace.	

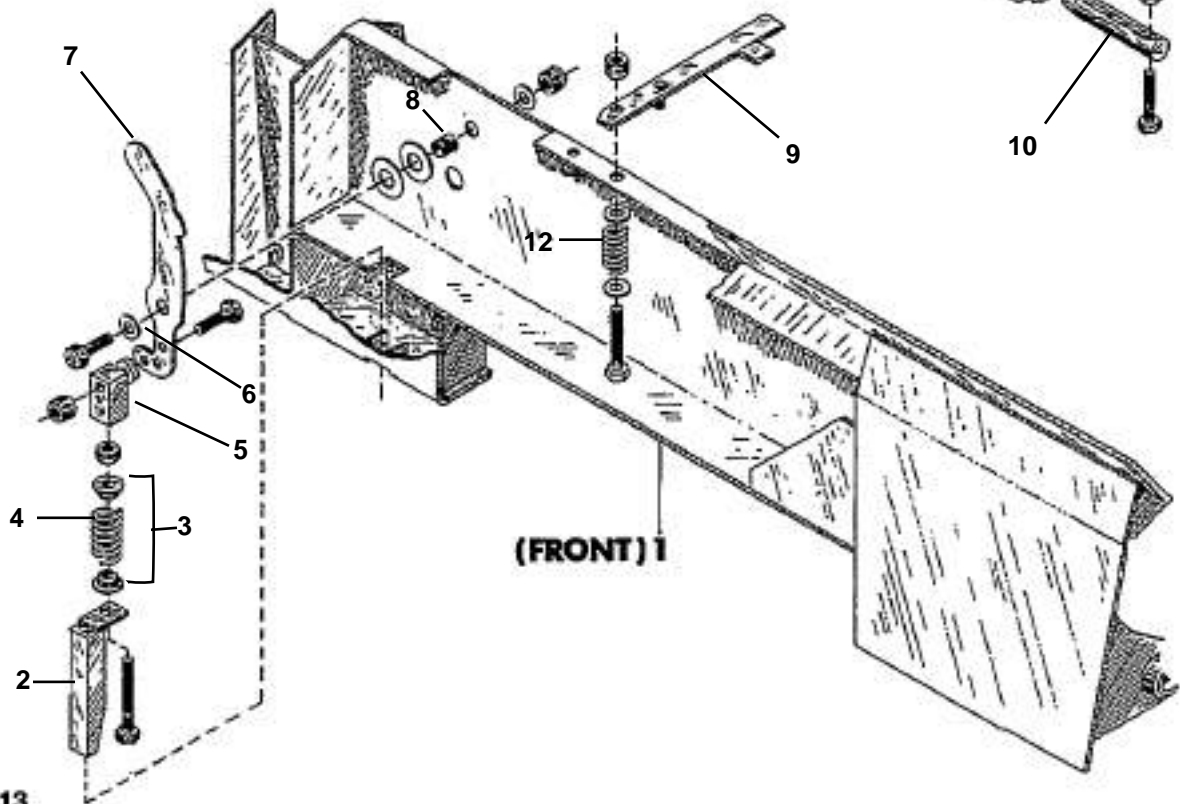
Low or no output from alternator	Drive belt slipping	Adjust.	7.3.5	
	Faulty wiring or connections	Check and repair.		
	Defective voltage regulator	Check and if necessary replace.	5.2.2	
	Defective alternator	Check and if necessary replace or rewind.	5.2.2	
Excessive alternator lamp dim	Faulty wiring or connections	Check and repair.		
	Dirty slip rings or brushes	Check and repair.		
Charge indicator green but becomes amber with increased speed	Faulty wiring or connections	Check and repair.		
	Faulty regulator	Check and if necessary replace.		
Charge indicator and "ON" with engine running	Drive belt slipping	Adjust.	7.3.5	
	Defective alternator or regulator	Perform a terminal voltage check of all.		
		Perform alternator current output test.		
		Perform alternator "B" output voltage test.		
		Perform regulator "M" output conductivity test.		
		Perform alternator "E" output conductivity test.		
		Perform alternator "F" output conductivity test.		
	Charge indicator and "OFF" with engine not running	Defective and/or loose lamp	Check and if necessary replace.	
		Defective wiring	Check wiring continuity between lamp and ignition switch.	
			Check wiring continuity between lamp and regulator "M" terminal.	
Check if there is continuity between regulator "M" and "F".				

6 MAIN FRAME

QUICK-TACH ASSEMBLY	6.1
Operation	6.1.1
Preventive maintenance	6.1.2
Removal	6.1.3
Disassembly	6.1.4
Assembly	6.1.5
Installation	6.1.6
BOOM ARMS	6.2
Removal	6.2.1
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OPERATOR GUARD (ROPS)	6.3
Removal	6.3.1
Installation	6.3.2
REAR DOOR	6.4
Removal	6.4.1
Installation	6.4.2



- | | |
|---------------------|-------------------------|
| 1. Quick-tach frame | 7. Lock handle |
| 2. Lock pin | 8. Bushing |
| 3. Spring collar | 9. Safety lock lever |
| 4. Spring lock pin | 10. Boom pivot pin |
| 5. Link block | 11. Tilt cylinder pin |
| 6. Tension washer | 12. Spring, safety lock |

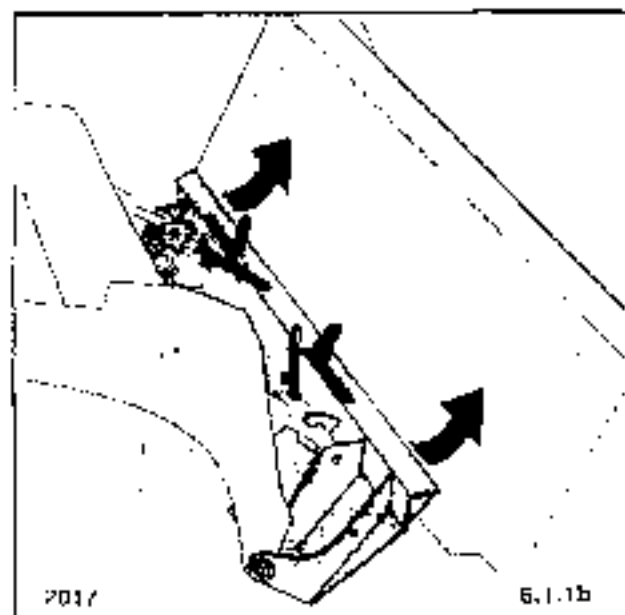
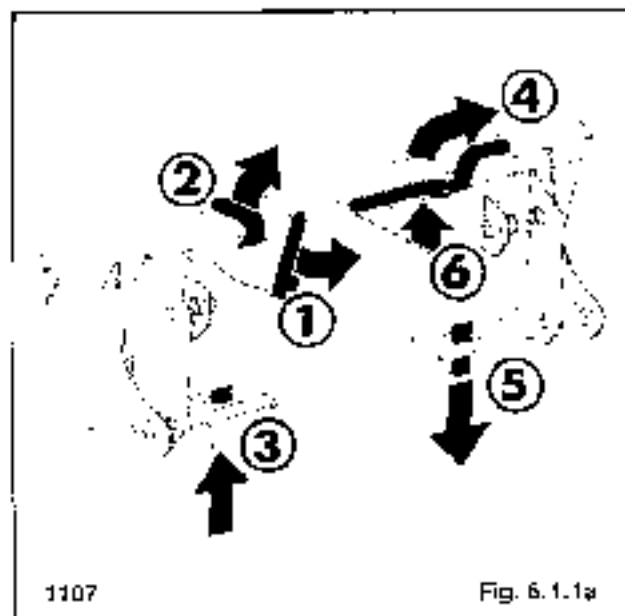


6 MAIN FRAME

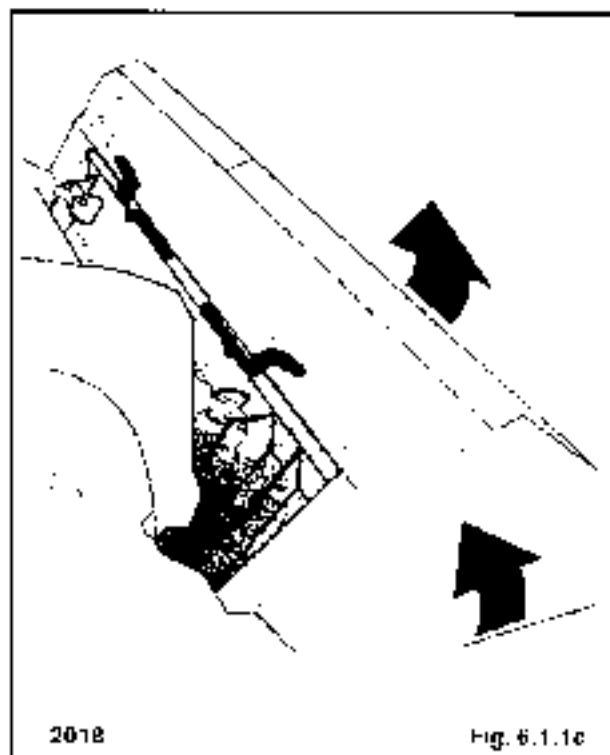
6.1.1 Quick-Tach Operation:

The quick-tach, which is standard equipment, allows changing from one attachment to another quickly without having to remove bolts or pins.

To operate, release the two safety locks (1) (Fig. 6.1.1a) and lift the two locking levers (2) up to completely retract the locking pins (3).



Tilt the quick-tach frame forward (Fig. 6.1.1b) with the bucket lift cylinders and drive into the attachment. Retract the bucket lift cylinders which will line up the bottom of the attachment with the quick-tach lock pins (Fig. 6.1.1c).



Push the locking levers down (4) (Fig. 6.1.1a) extending the lock pins (5) through the attachment and engage the safety lock (6).

Before operating the attachment check that the locking pins and safety locks are correctly engaged.

IMPORTANT

After hook up to attachment check to be sure pins are fully engaged.

6.1.2 Quick-Tach — Preventive Maintenance

To keep the quick-tach locking pins and linkage working freely and to prevent pivot pin and bushing wear the quick-tach must be serviced every 8 hours. More often in dirty applications.

Service the quick-tach and pivot pins as follows:

1. Remove any attachment from the quick-tach.
2. Clean any dirt build up around the linkage assembly inside the quick-tach.
3. Lubricate the grease fittings on back of the bucket cylinder bushings. Use a good quality multi-purpose lithium based grease until excess shows.
4. Raise the boom arms and engage the boom locks.

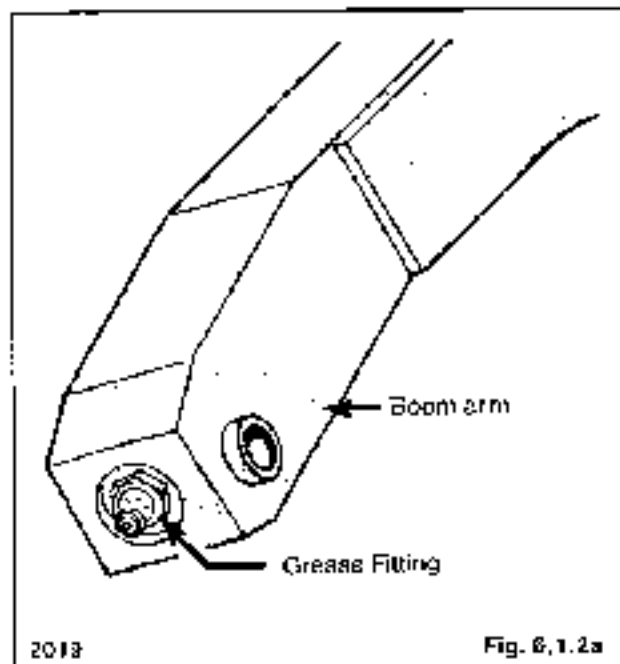
6 MAIN FRAME



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.

5. Lubricate the lower boom arm pivot bushings (Fig. 6.1.2a). Use a good quality multi-purpose lithium based grease until excess shows.



6. Inspect the boom and bucket pivot pins for wear. If any wear is detected replace the pins.

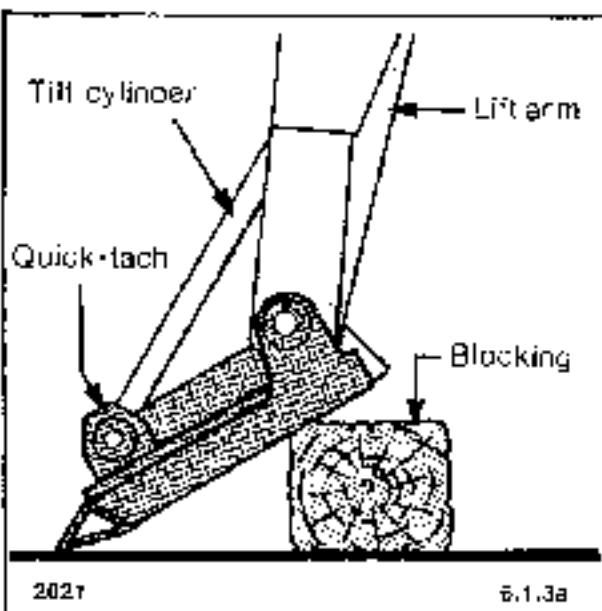
6.1.3 Quick-Tach Removal

1. Start the engine. Raise the lift arms. Place a block under the rear of the quick-tach frame. Lower the lift arms until the rear of the quick-tach is supported by the block (Fig. 6.1.3a).
2. Tilt the quick-tach frame forward until the front of the frame rests securely on the ground (Fig 6.1.3b).

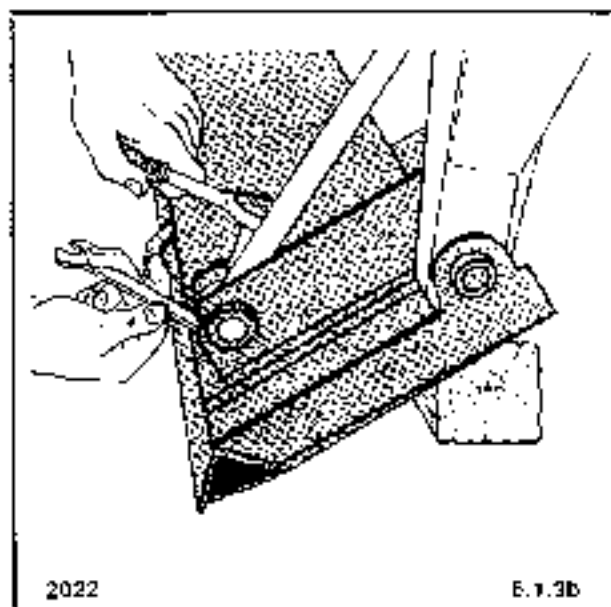


WARNING

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



3. Shut off the engine and engage the parking brake. Cycle the foot pedals to relieve any hydraulic pressure in the system.
4. Remove the lock-nut and bolt from the bucket cylinder rod end pins (Fig. 6.1.3b).

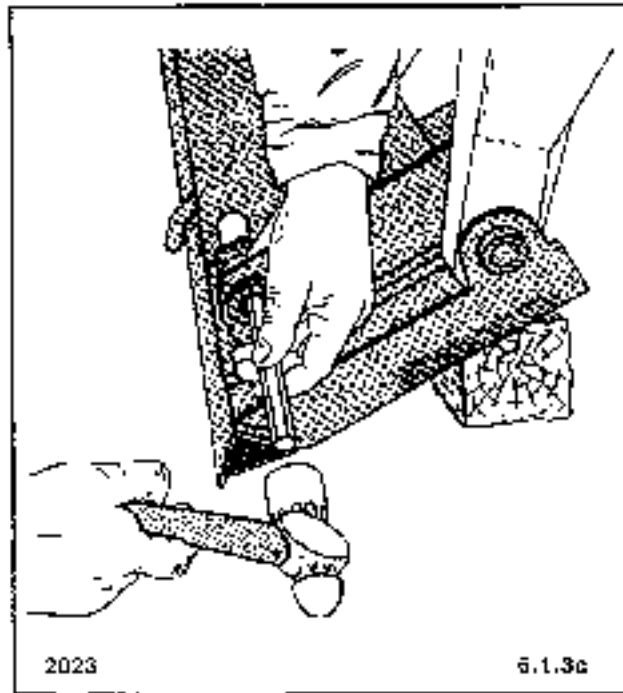


WARNING

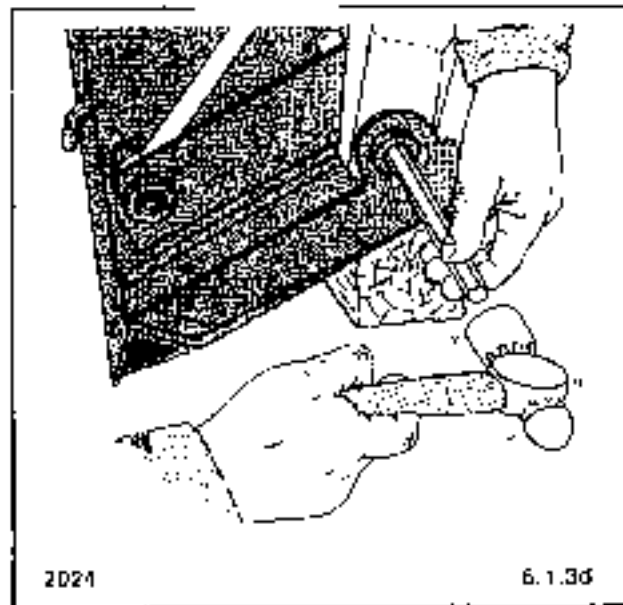
To avoid eye injury wear safety glasses and always use a brass drift and hammer to remove or install pins.

6 MAIN FRAME

5. Using a brass hammer and punch (Fig. 6.1.3c). Remove the bucket cylinder rod and pivot pins.

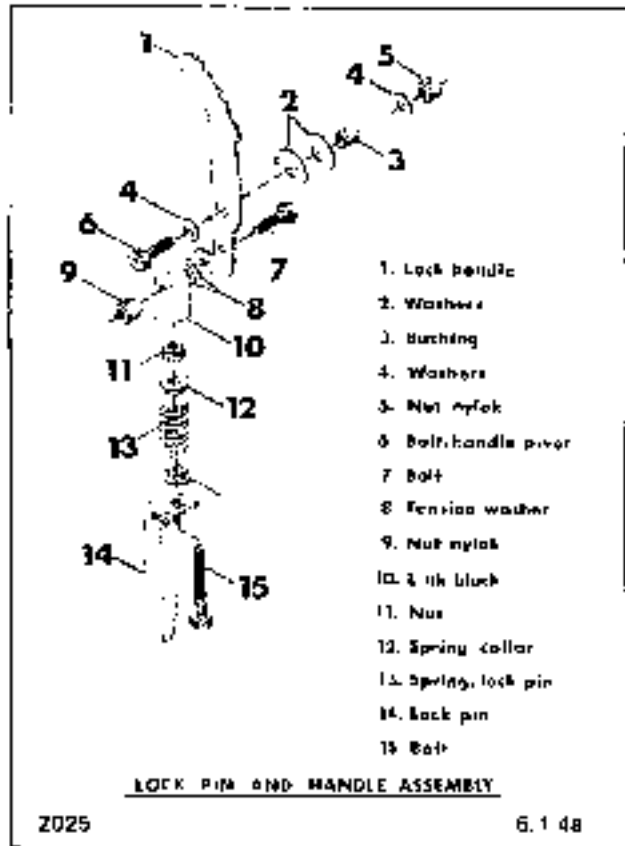


6. Remove the locknut and bolt from the lower boom hinge pins.
7. Using a brass punch and hammer, remove the lower boom hinge pins (Fig. 6.1.3c).

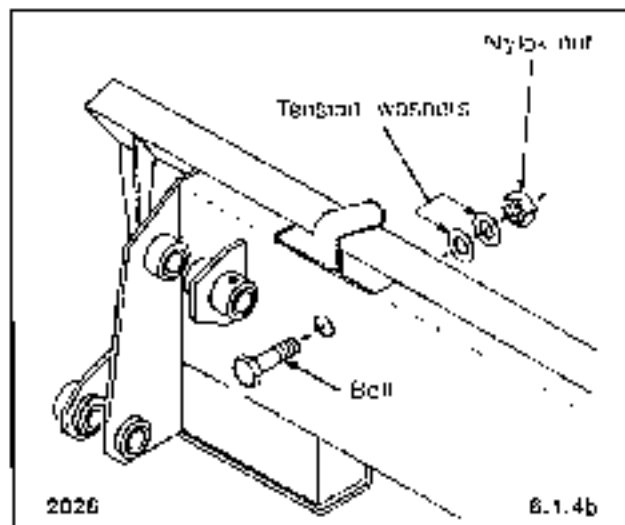


8. Remove the quick-tach assembly from the loader.

6.1.4 Quick-Tach — Disassembly

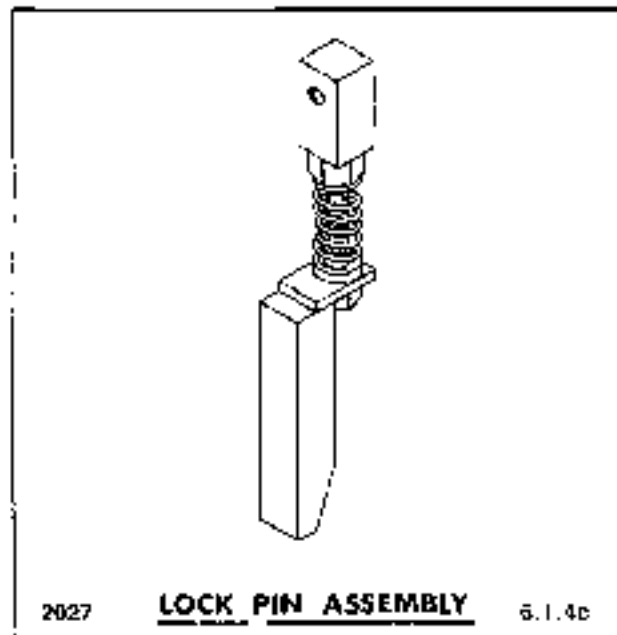


- 1) Using the lock handle line up the bolt (7), which secures the link block (10) to the lock handle, with the hole in the backplate of the quick-tach frame (Fig. 6.1.4a).
2) Remove the bolt (7), tension washers (8) and nylok nut (9) from the quick-tach frame (Fig. 6.1.4b).



6 MAIN FRAME

3. Remove the lock handle nut (5) and washer (4) — Figure 6.1.4a. Remove the bushing (3), washers (2), handle (1), washer and bolt (6) from inside the quick-tach frame.
4. Remove the lock and pin spring assembly from the quick-tach frame (Fig. 6.1.4c).

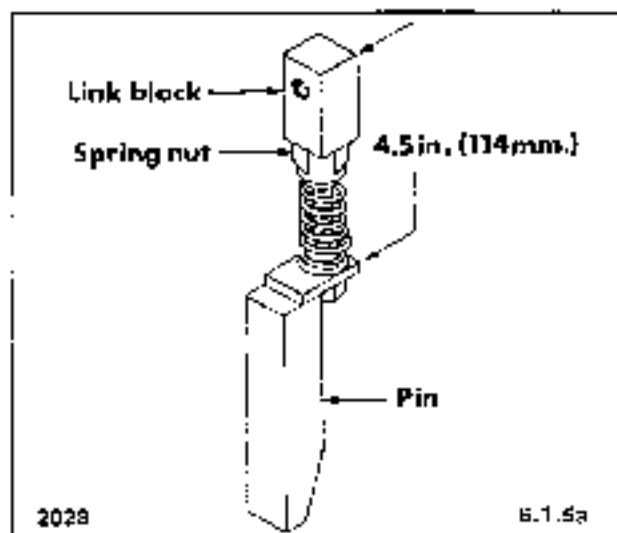


6.1.5 Quick-Tach — Assembly

Assembly of the quick-tach generally follows the disassembly procedure in reverse. Refer to section 6.1.4.

Before installing the lock pin and spring assembly, adjust the spring nut so there is a slight tension on the spring.

Adjust the link block so it is 4.5 inches (114 mm) above the pin (Fig. 6.1.5a).

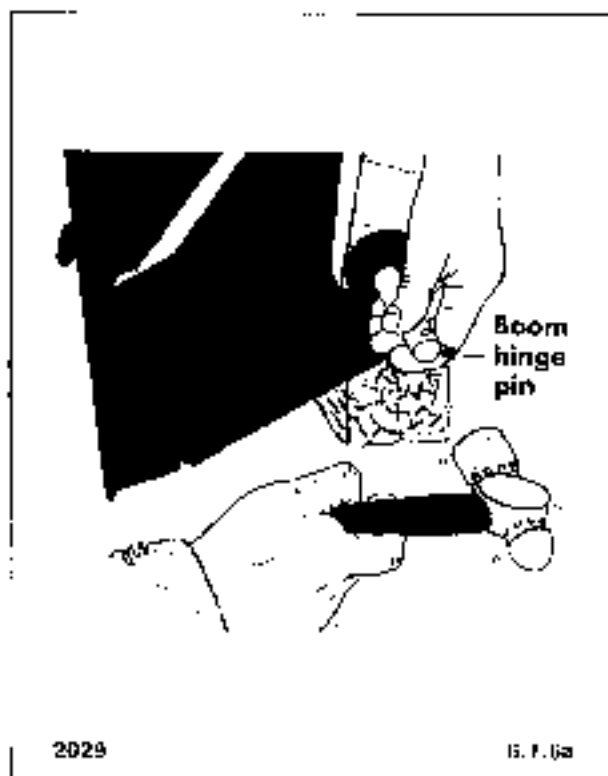


6.1.6 Quick-Tach Installation

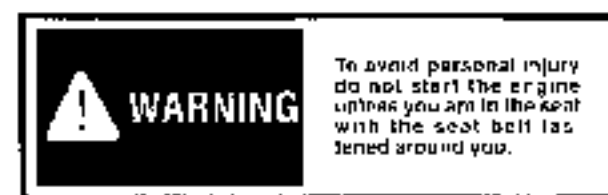
1. Place a floor jack under the quick-tach. Position the quick-tach between the lift arms.
2. Raise the quick-tach with the floor jack and line up the boom hinge bushing with the bottom quick-tach bushing.



3. Install the boom hinge pin (Fig. 6.1.6a).

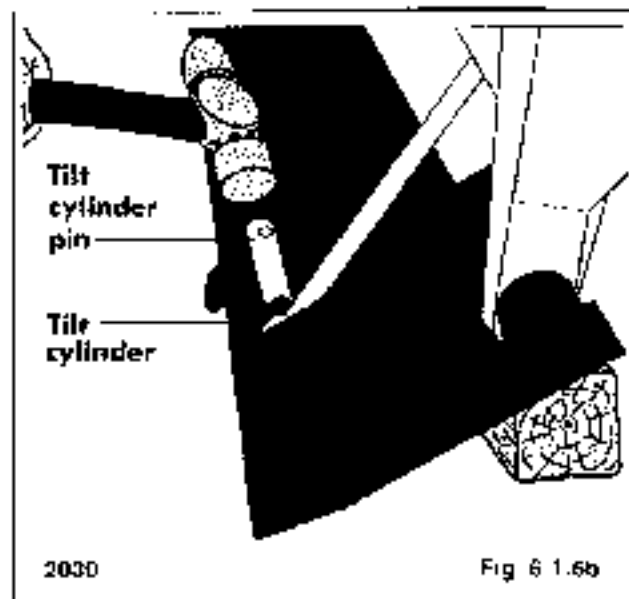


4. Install the raylok nut and lock in the boom hinge pin (Fig. 6.1.6a).
5. Extend the bucket cylinders until the cylinder rod end bushings line up with the quick-tach bushings.



6 MAIN FRAME

6. Install the bucket cylinder pins. (Fig. 6.1.6b).

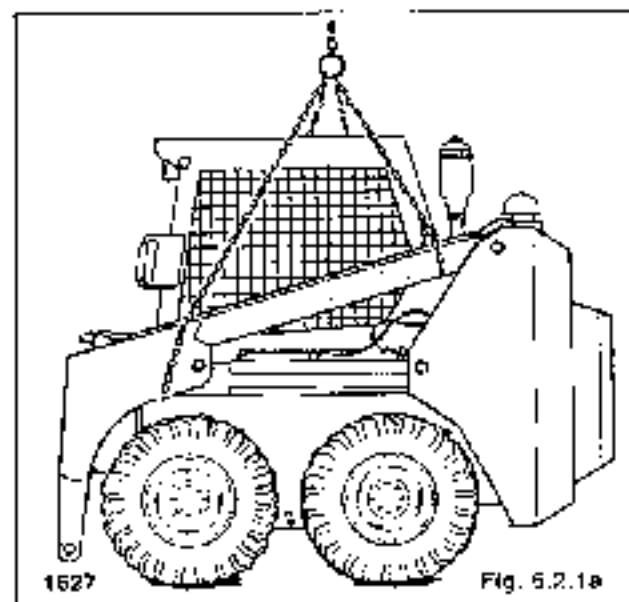


7. Install the nylok nut and bolt in the pivot pin.

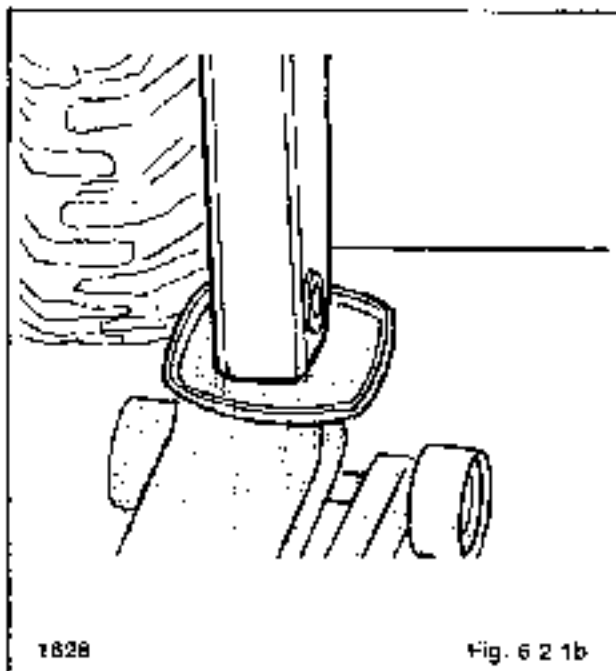
6.2 BOOM ARMS

6.2.1 Boom Arms — Removal

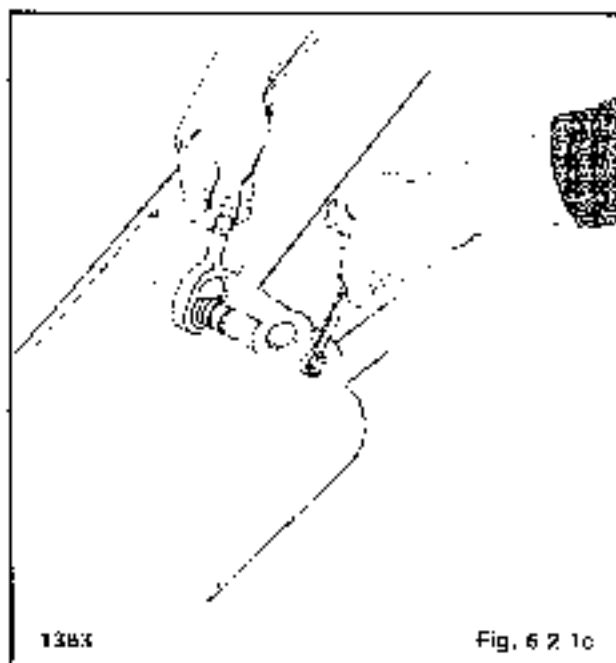
1. Stop the engine and cycle the foot pedals to relieve any hydraulic pressure in the system.
2. Remove the quick-tach assembly from the boom arms. Refer to section 6.1.3.
3. Fasten chains and a chain hoist to the boom arms. (Fig. 6.2.1a)



4. Place a floor jack under the boom arms. (Fig. 6.2.1b).



5. Lock the boom lift foot pedal in float position. Refer to section 4.2.1.
6. Raise the boom arms with the floor jack until the pivot pins on the rod ends of the boom lift cylinders can be removed.
7. Remove the nylok nuts and bolts from the boom lift pivot pins. (Fig. 6.2.1c).



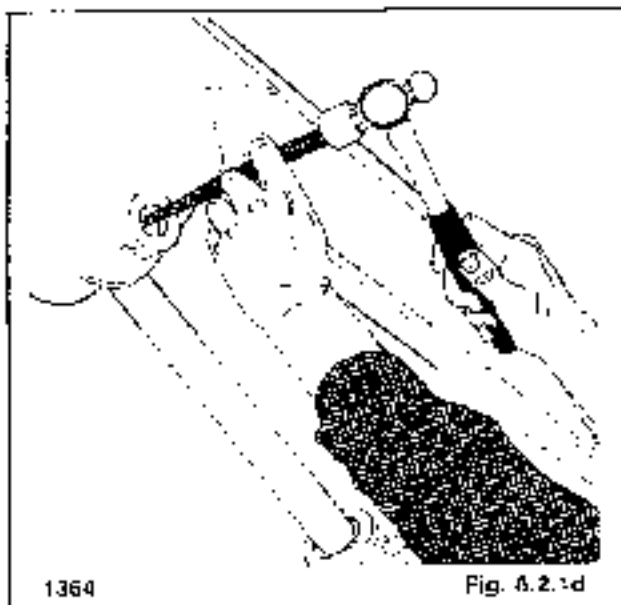
6 MAIN FRAME



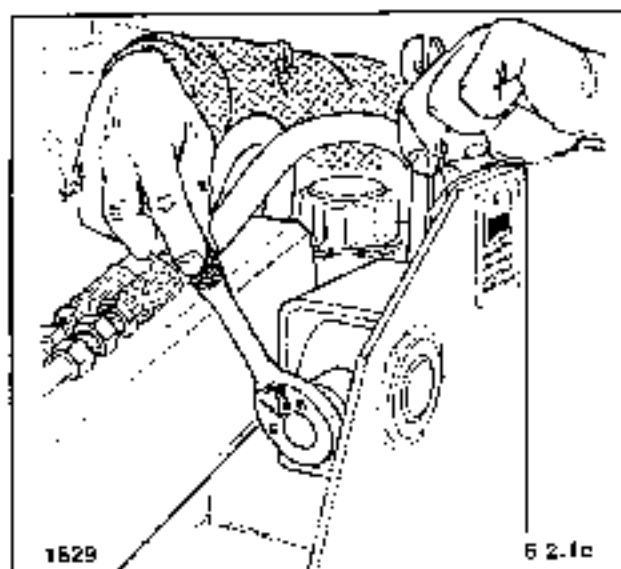
WARNING

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

- Place a support under the boom lift cylinders to prevent them from falling and remove the cylinder pivot pins. (Fig. 6.2.1d).



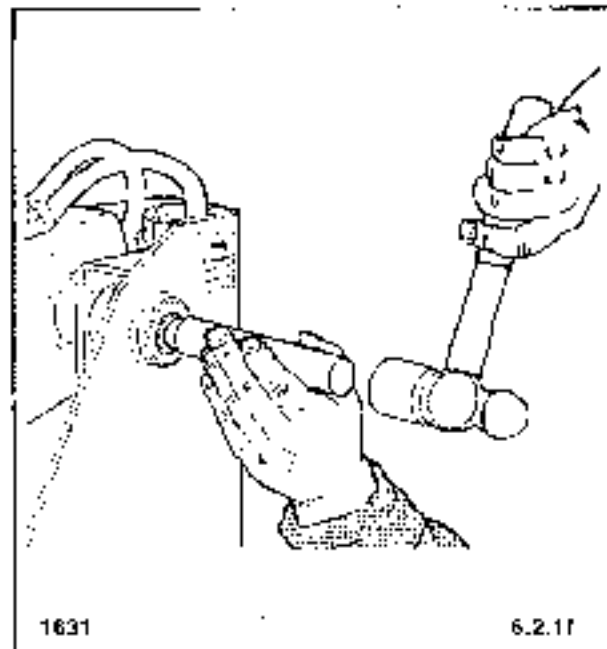
- Lower the boom arms and remove the floor jack.
- Remove the nylon nut and bolt from the rear boom hinge pin. (Fig. 6.2.1e).



WARNING

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

- Tighten the chain hoist and remove the rear door pivot pins. (Fig. 6.2.1f).



- Raise the boom with the chain hoist and remove from loader.

6.2.2 Boom Arms — Installation

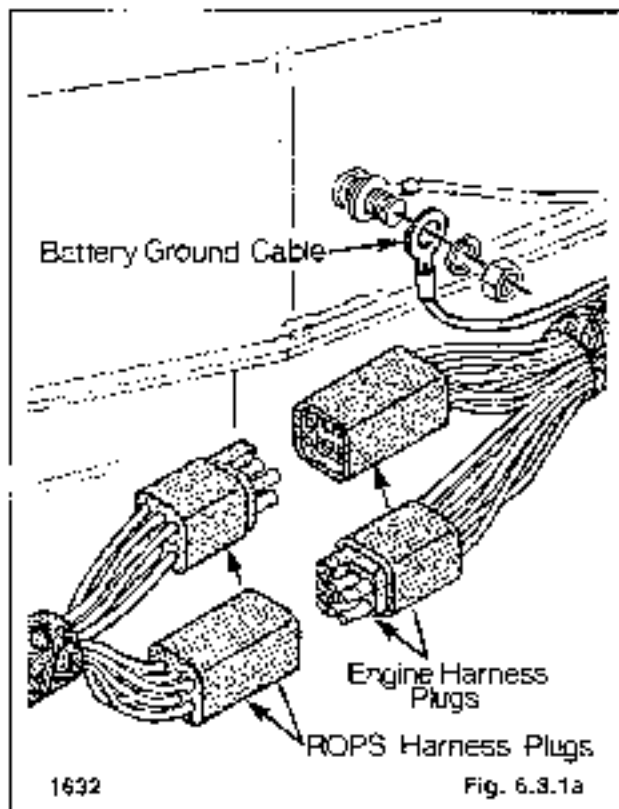
Installation of the boom arms follows the removal procedure in reverse. Refer to section 6.2.

6.3 OPERATORS GUARD (ROPS)

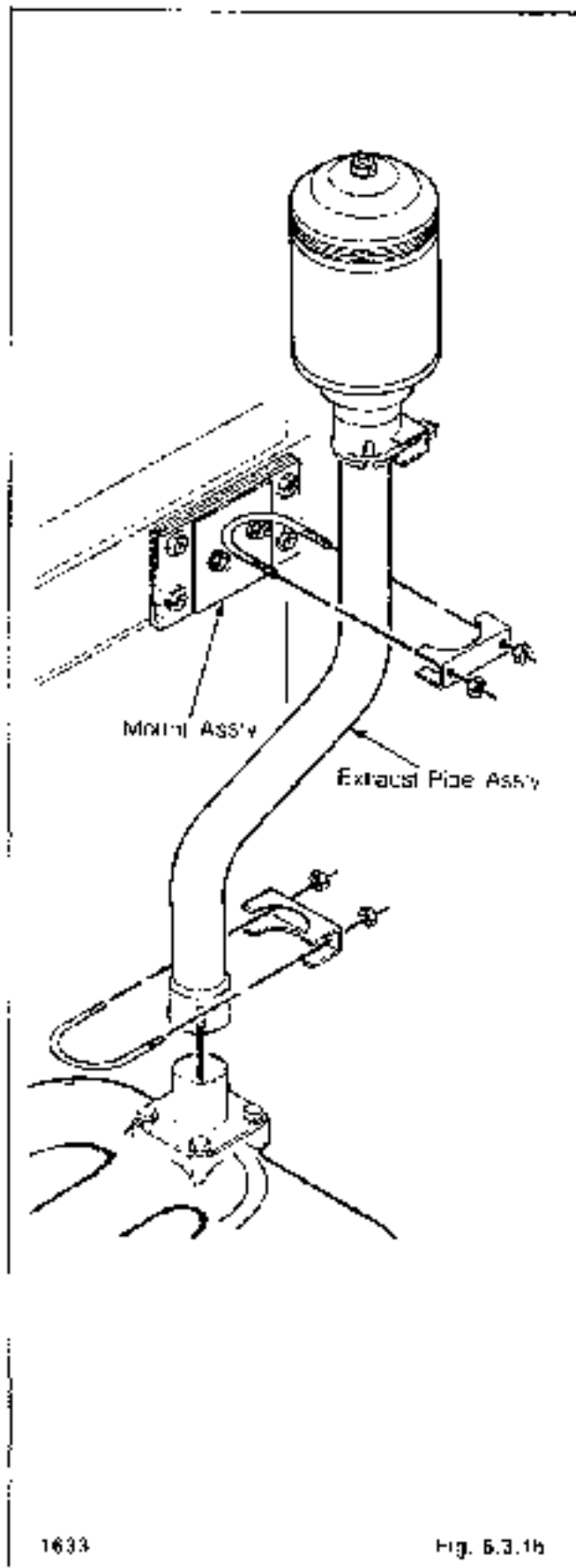
6.3.1 Operators Guard (ROPS) Removal

- Disconnect and remove the battery from the operators guard (ROPS). Refer to section 5.3.2 for procedure.
- Disconnect the battery cable from the starter motor solenoid. Remove the battery cable from the loader.
- Disconnect the engine wiring harness from the ROPS wiring harness from the plug connections inside the engine compartment.
- Disconnect the battery ground cables from the loader main frame. (Fig. 6.3.1a) Remove the cable from the loader.

6 MAIN FRAME

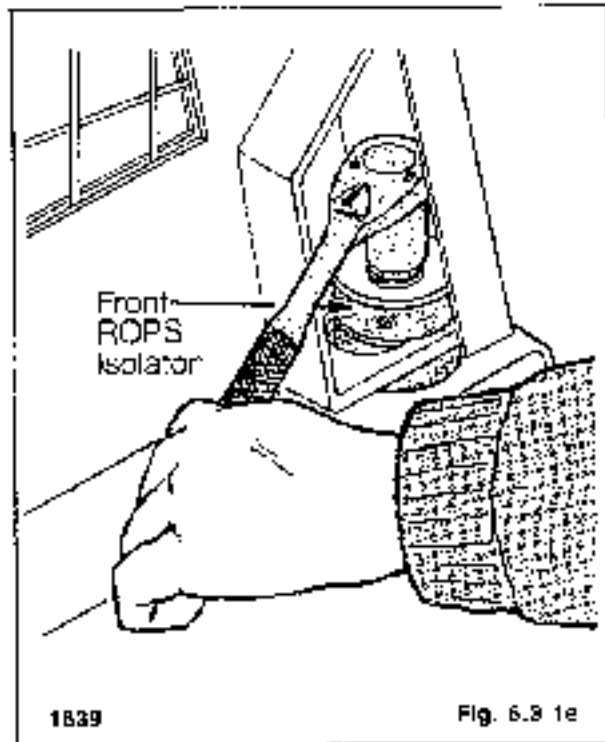


5. Remove the exhaust pipe and the exhaust pipe mount. (Fig. 6.3.1b).
6. Remove the seal assembly from the loader.

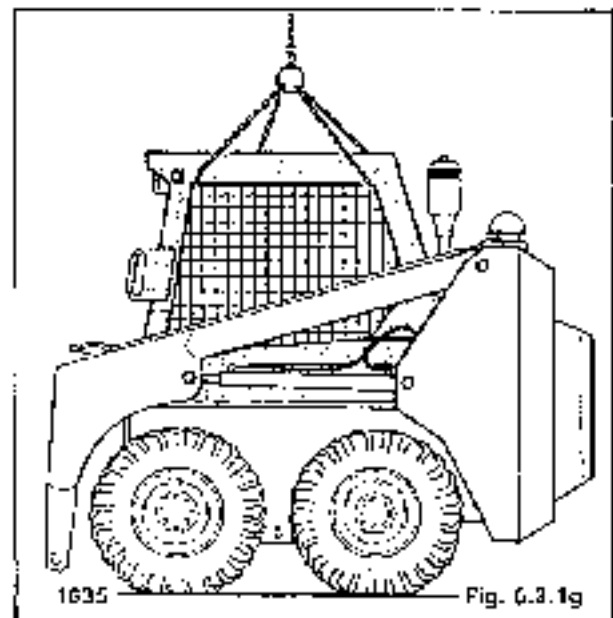


6 MAIN FRAME

7. Disconnect the wire going to the safety start switch on the foot pedal lock.
8. Remove the two front and two rear ROPS isolators (Fig. 6.3.1e).



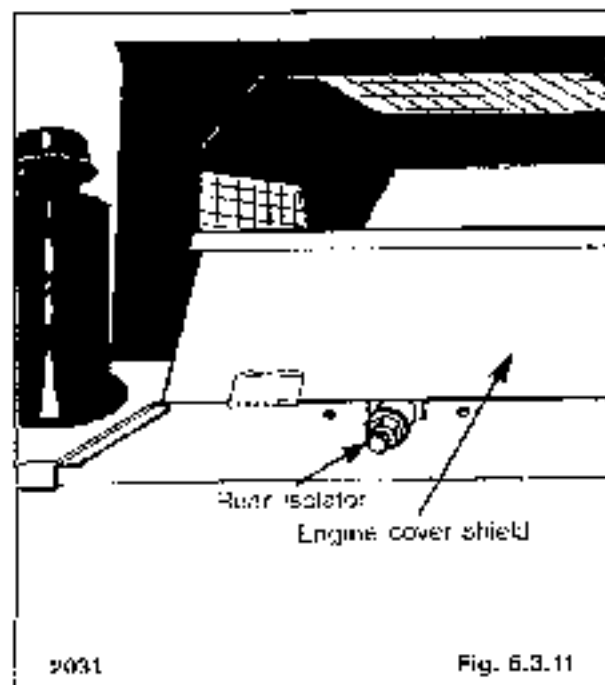
10. Attach chains and a chain hoist to the ROPS as shown in fig. 6.3.1g. Remove the ROPS from the loader.



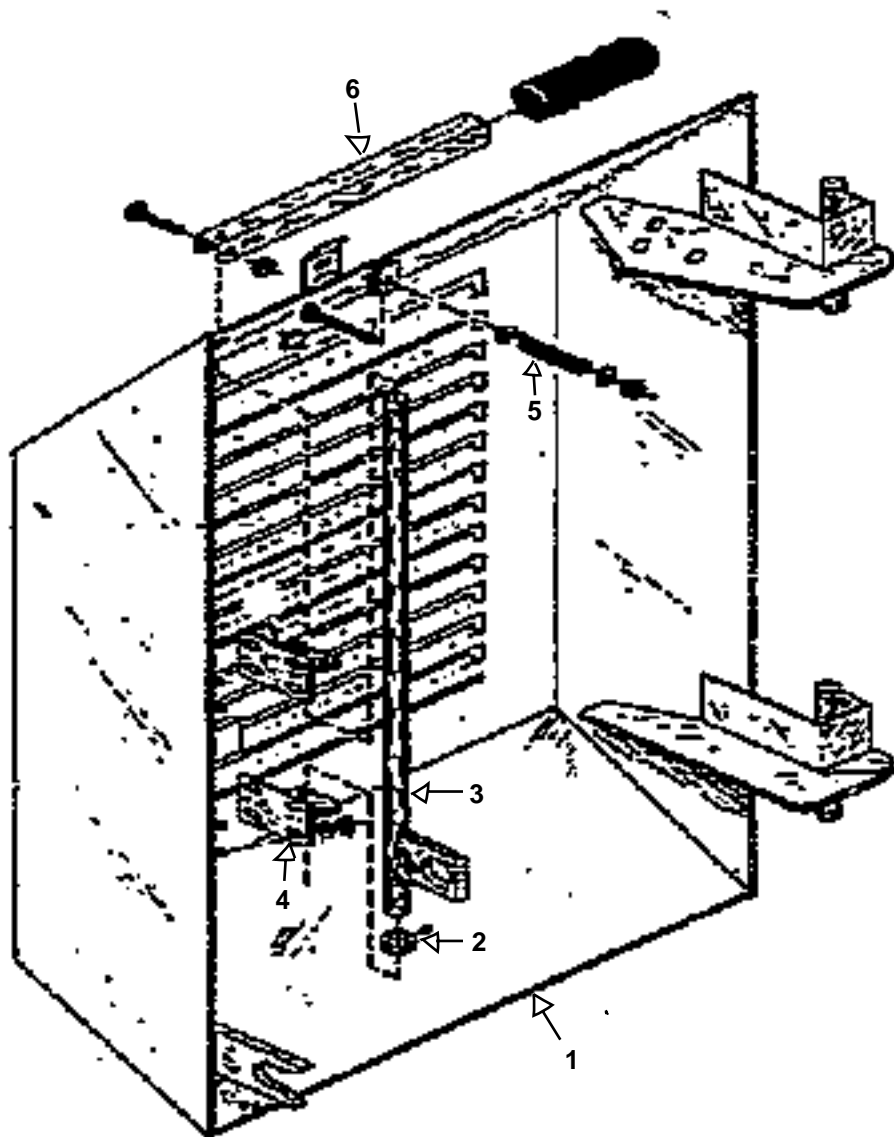
6.3.2 Operators Guard (ROPS) Installation

Installation of the operators guard (ROPS), generally follows the removal procedure in reverse. Refer to section 6.3.1.

9. Remove the rear ROPS isolator (Fig. 6.3.11).



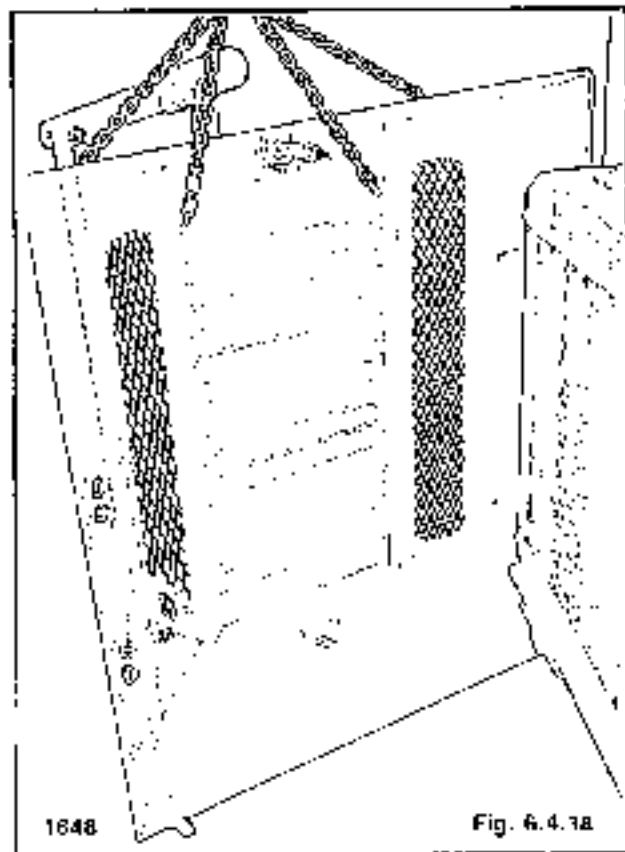
6 MAIN FRAME



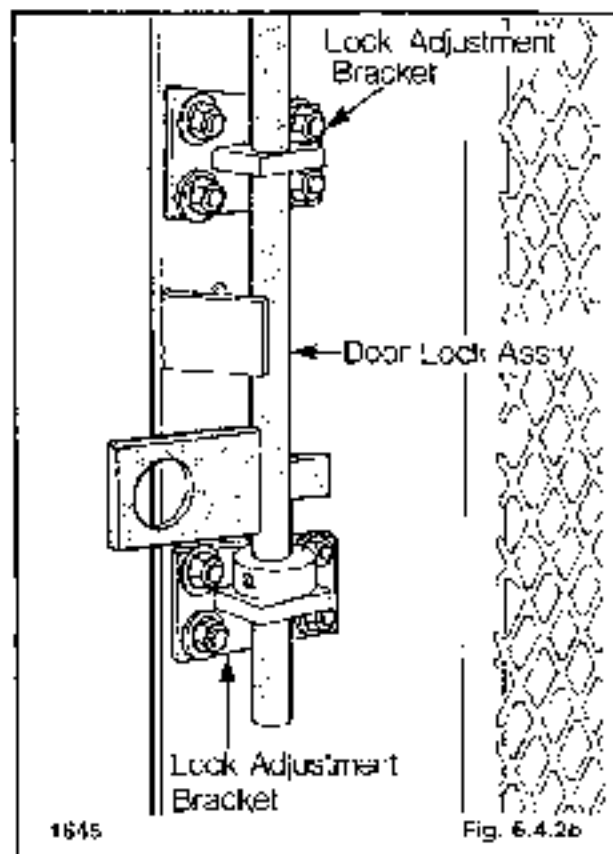
- 1. REAR DOOR
- 2. SET COLLAR
- 3. LOCK SHAFT
- 4. LOCK SUPPORT
- 5. SPRING
- 6. HANDLE

6 MAIN FRAME

2. Attach chains and a chain hoist to the rear door (Fig. 6.4.1a). Lift the rear door clear of the hinges and remove from the loader.



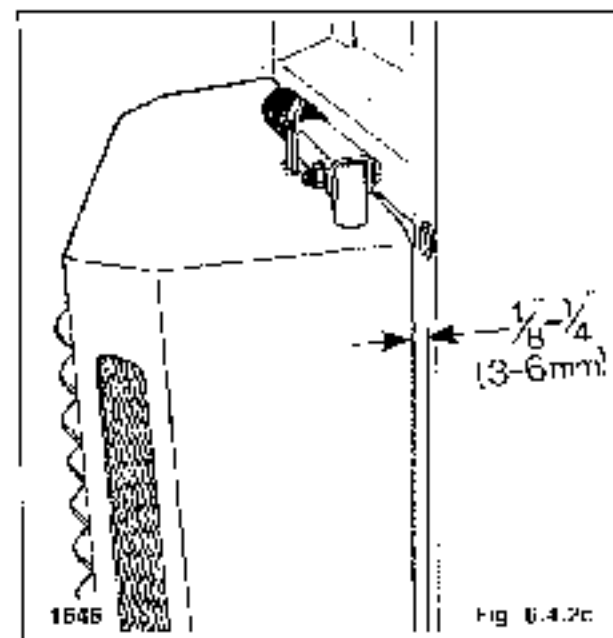
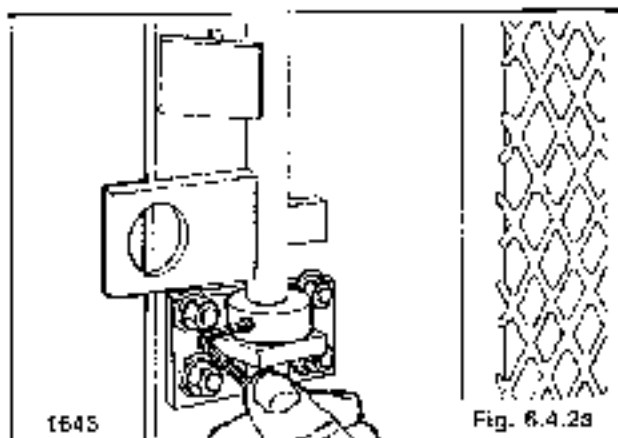
2. Set the lock support brackets (Fig. 6.4.2b), so that the door when shut has an even gap from top to bottom of approximately $\frac{1}{8}$ " (3-6 mm). Figure 6.4.2c.



6.4.2 Rear Door — Installation

Installation of the rear door generally follows the removal procedure in reverse. Refer to 6.4.1.

1. Adjust the set collar on the lock rod so that the lock rod lines up with the pin on the main frame (Fig. 6.4.2a).



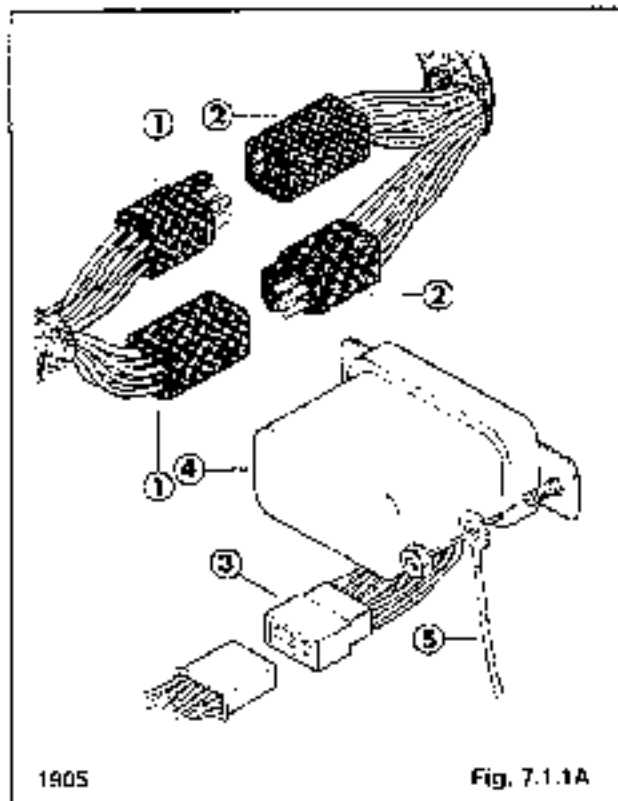
**NOTE: FOR COMPLETE ENGINE SERVICE AND REPAIR PROCEDURES
REFER TO THE KUBOTA WORKSHOP MANUAL**

7 ENGINE

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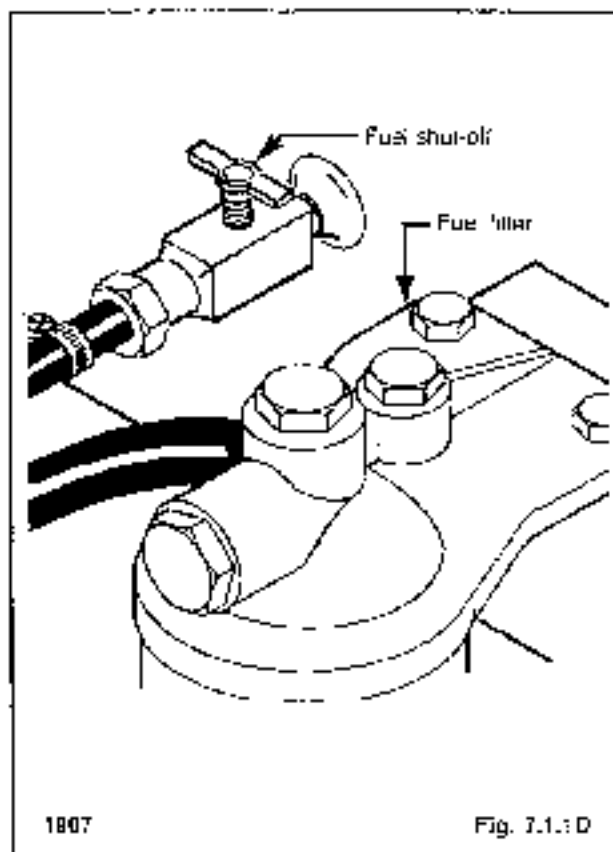
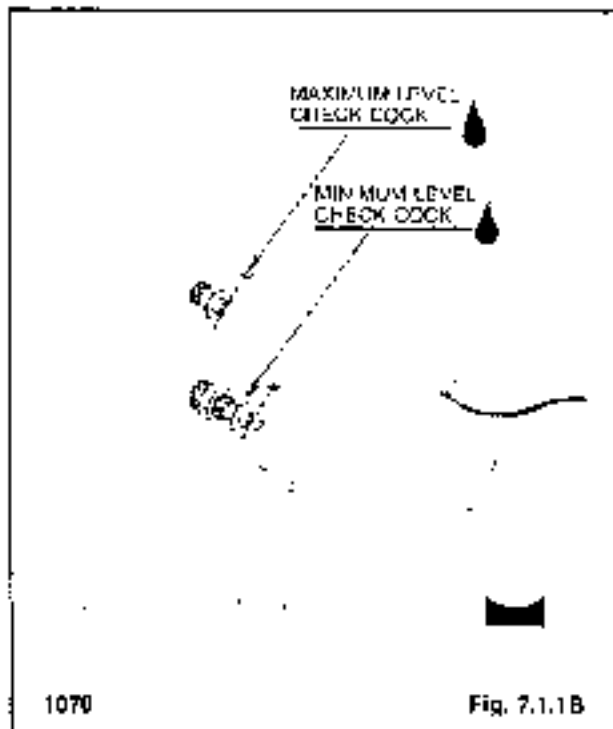
7.1.1 Engine Removal

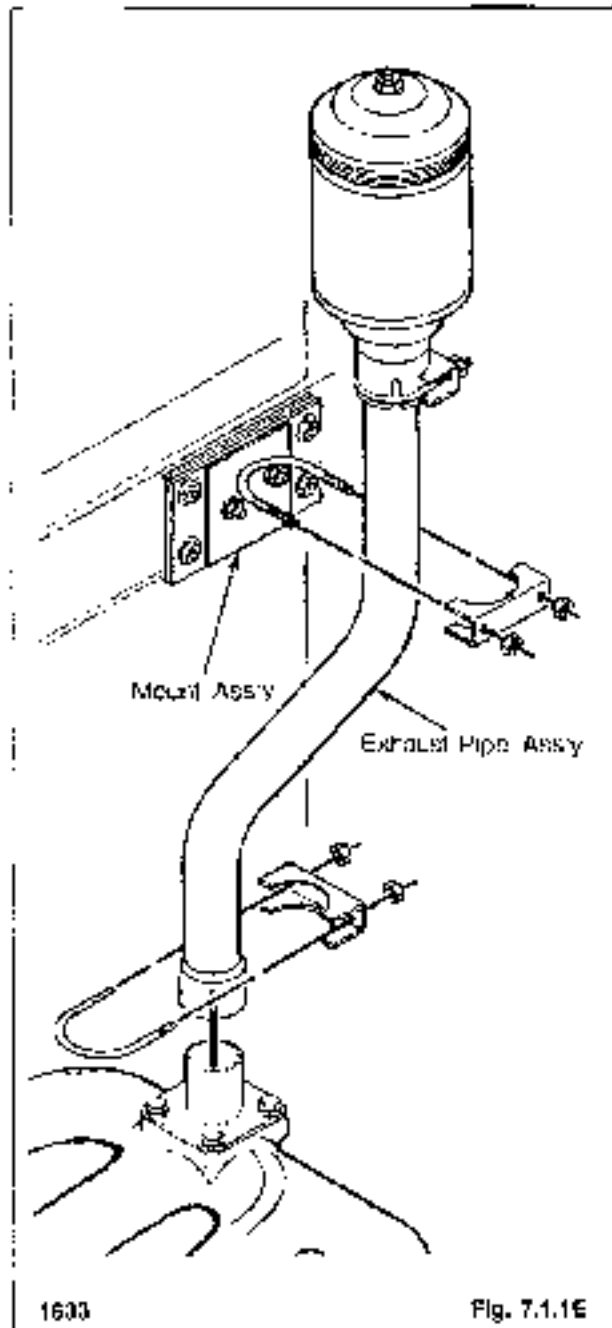
1. Disconnect the battery cables at the battery. Remove the positive or ground cable that
2. Disconnect the battery cable from the starter motor solenoid
3. Disconnect the engine wiring harness from the ROPS wiring harness at the plug connections inside the engine compartment (Fig. 7.1.1A)
4. Disconnect the voltage regulator harness at the plug connection (Fig. 7.1.1A)
5. Disconnect the ground wire from the voltage regulator mount (Fig. 7.1.1A).



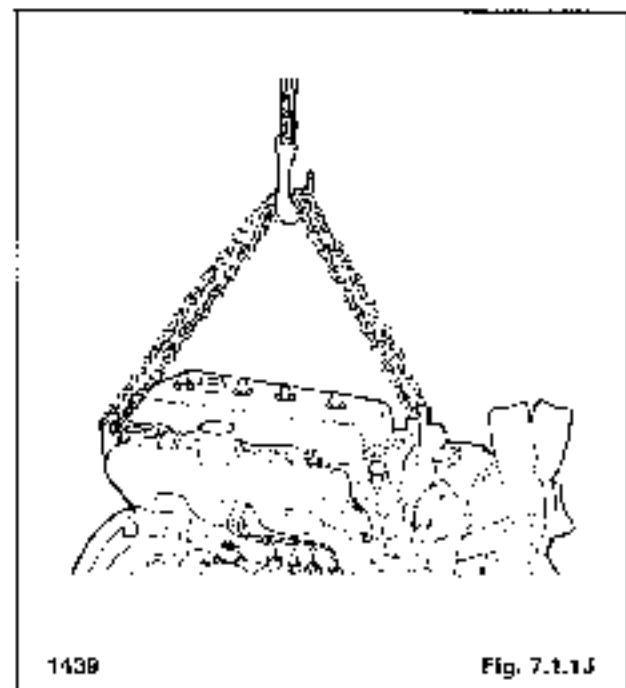
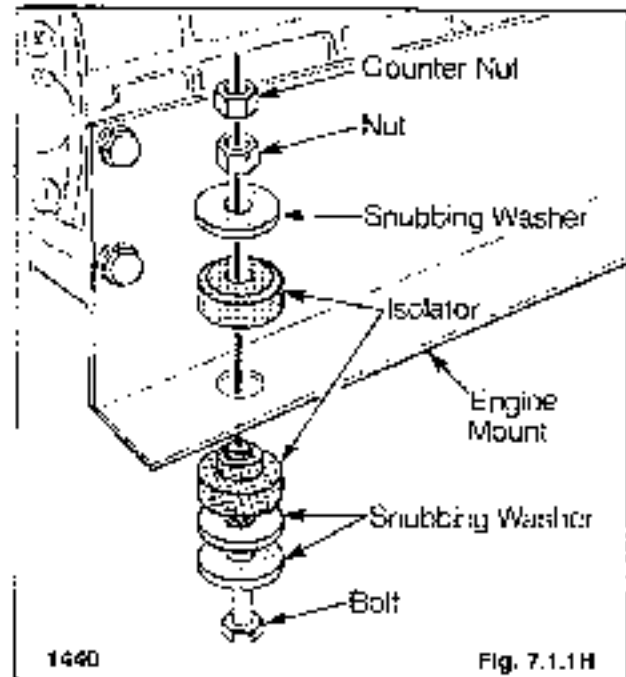
6. Disconnect the hydraulic oil temperature sender wire from the sender on the oil reservoir (Fig. 7.1.1B). Be sure the wire is completely disengaged from the engine
7. Disconnect the engine ground wire
8. Shut off the fuel at the fuel tank (Fig. 7.1.1D).
9. Disconnect the fuel line from the fuel lift pump and injection pump.
10. Disconnect the fuel overflow line from the injector.

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11. Remove the exhaust pipe (Fig. 7.1.1E).
12. Remove the engine compartment shield from the loader.
13. Disconnect the air intake hose from the intake manifold.
14. Disconnect the throttle control rod from the throttle lever assembly on the fuel injection pump.
15. Remove the engine mounting bolts (Fig. 7.1.1H).
On reassembly torque the mounting nuts to 40 ft. lbs. (54 N.m.). Torque the counter nuts against the mounting nuts 80 ft. lbs. (108 N.m.).



16. 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's 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).

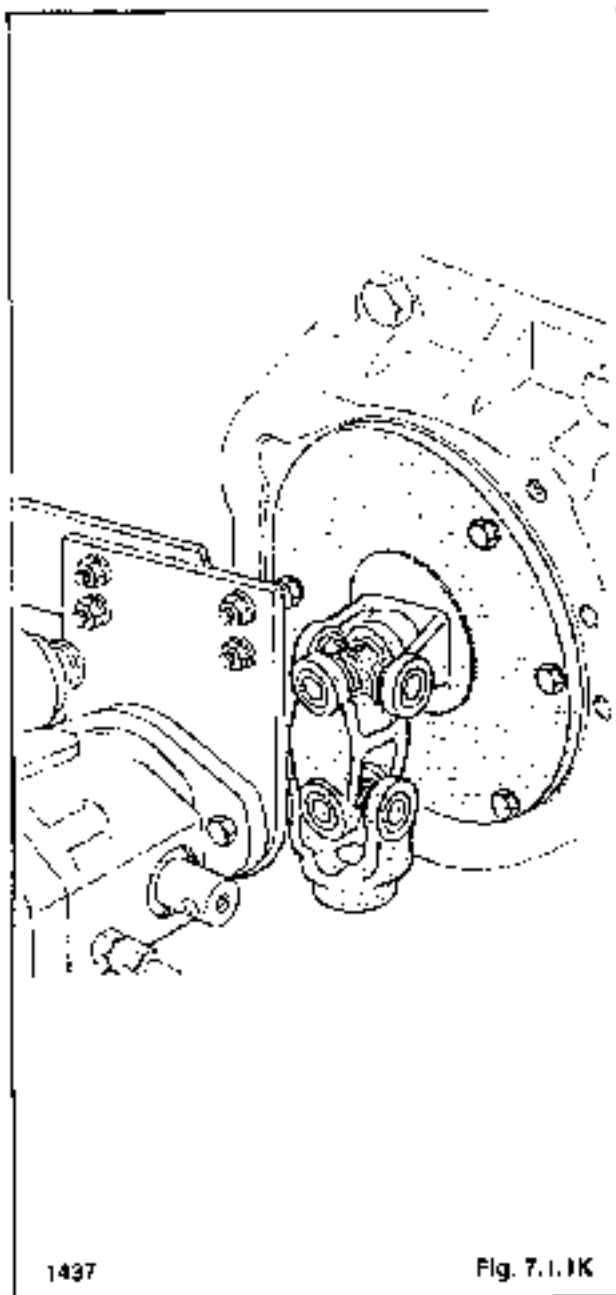


Fig. 7.1.1K

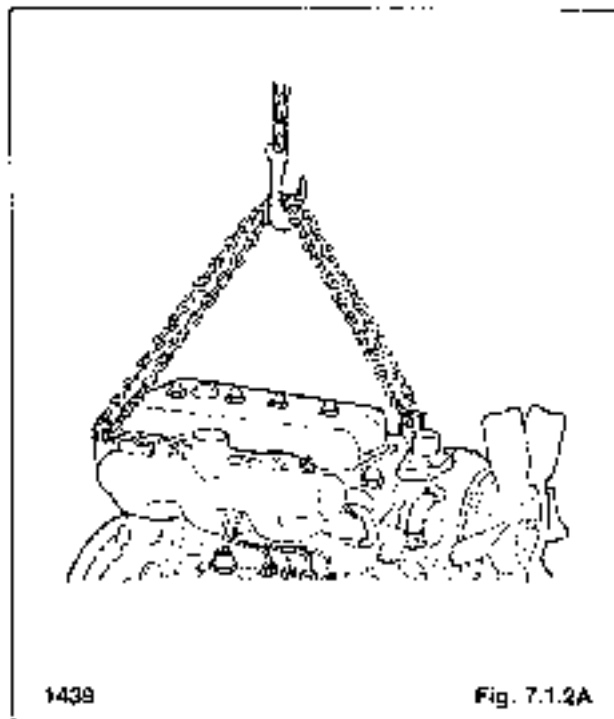


Fig. 7.1.2A

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 load: 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 nuts to 40 ft lbs. Torque the counter nut against the mounting nut 80 ft lbs. (Fig. 7.1.2C).

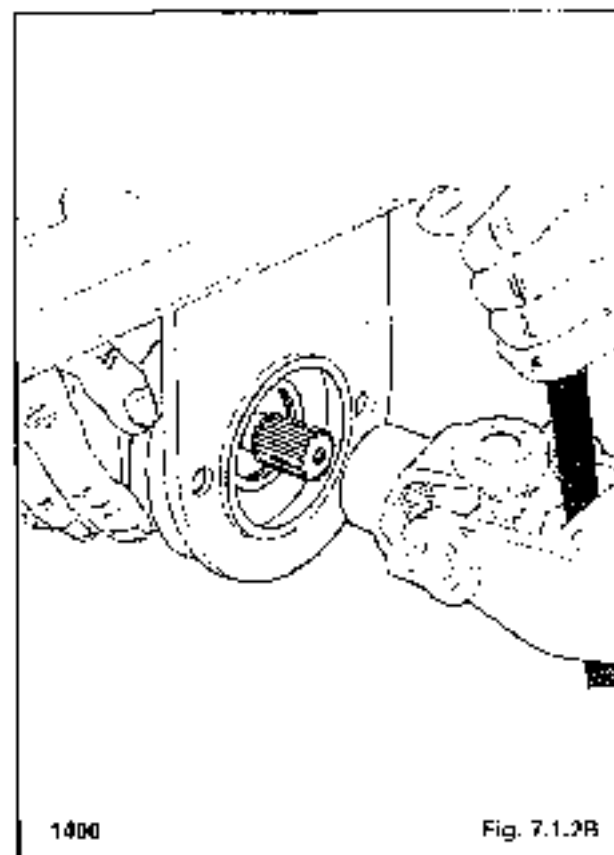
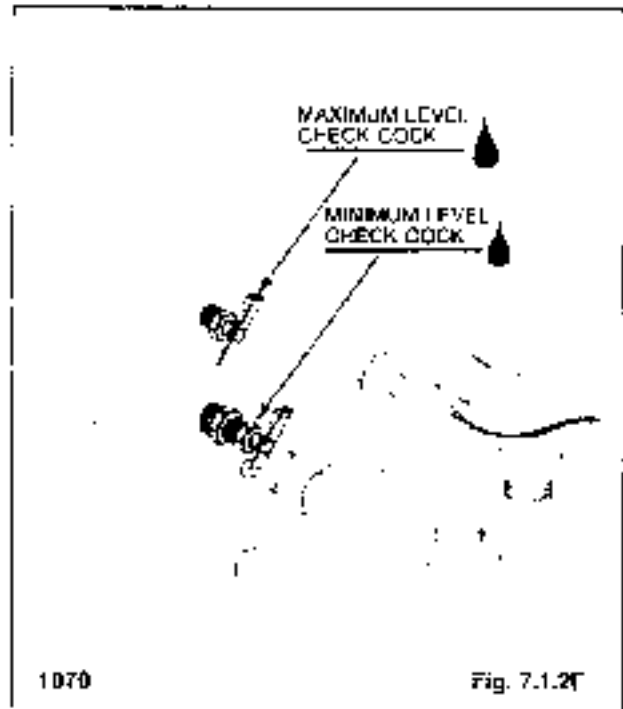
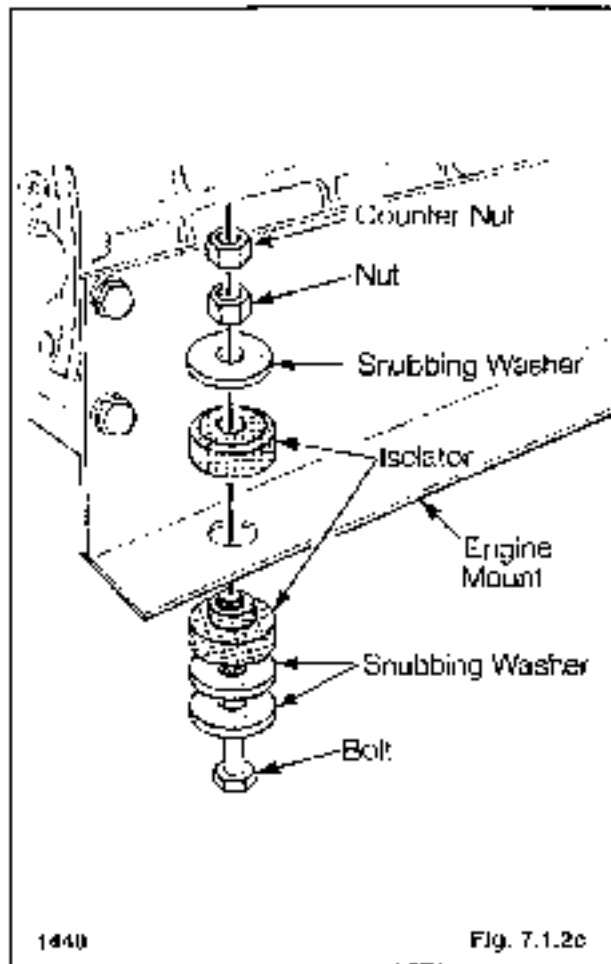
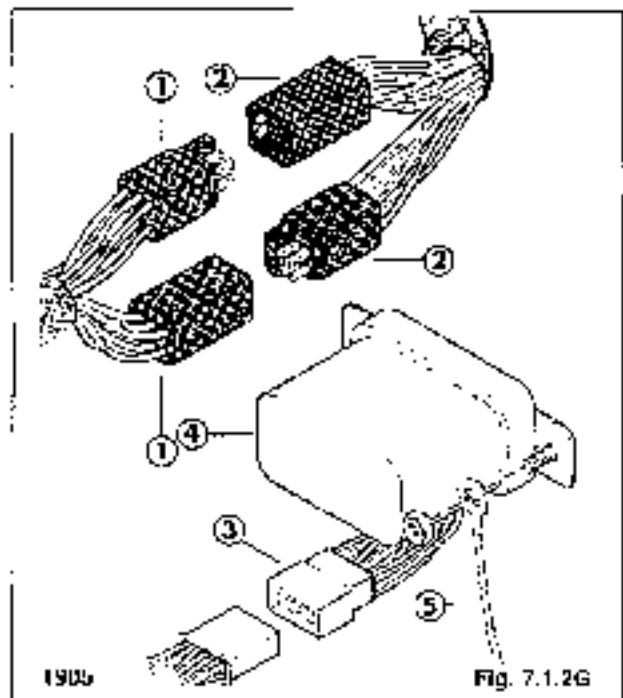


Fig. 7.1.2B



4. Connect the throttle control rod to the throttle lever assembly on the fuel injection pump.
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 with the tilt 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.
11. Connect the wire to the hydraulic oil temperature sensor (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).

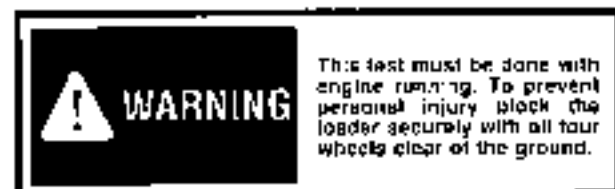
14. Connect the engine wiring harness with the ROPS wiring harness (Fig. 7.1.2g).
15. Connect the battery cable to the starter motor solenoid.
16. Connect the battery cables to the battery.



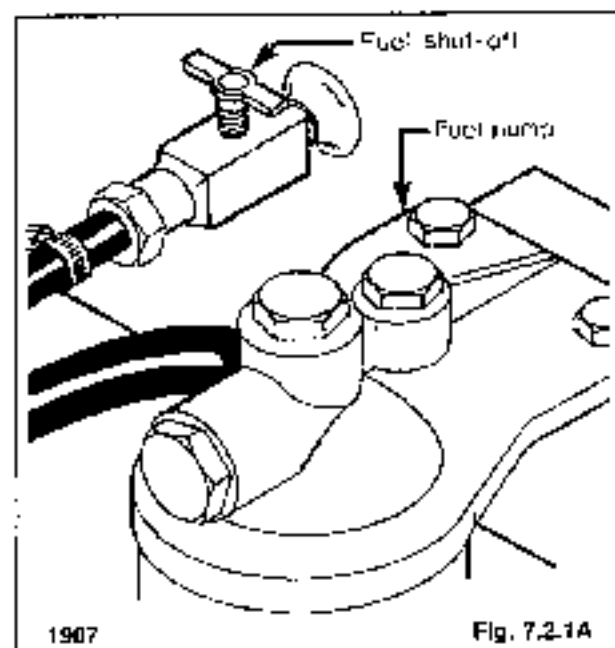
7.2 CYLINDER HEAD

7.2.1 Compression Test:

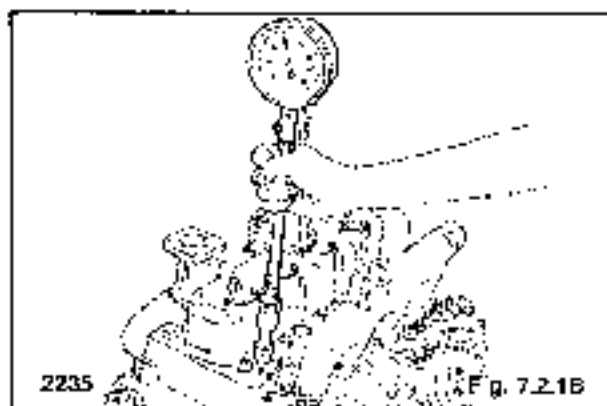
Before performing the compression test ensure that the battery is fully charged and that the valve clearances are correct.



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.



TEST RESULTS	189HD (V2203)	233HD (S2800B)
Reference compression pressure	398-441 lb./sq. in. (28-31 kg/cm ²)	441 lb./sq. in. (31 kg/cm ²)
Minimum allowable pressure	315 lb./sq. in. (22 kg/cm ²)	327 lb./sq. in. (23 kg/cm ²)
Difference between cylinder pressures	less than 10%	

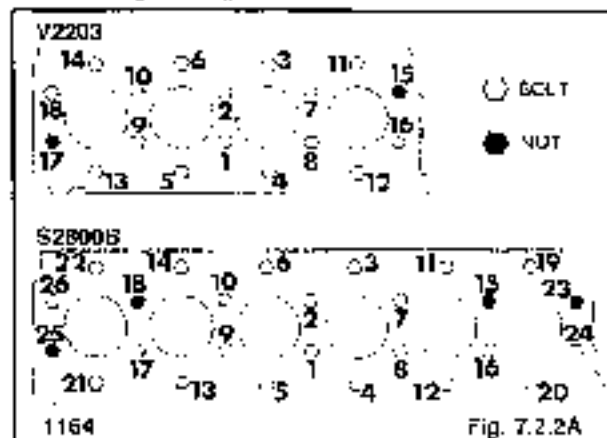
If the compression pressure is low pour a small amount of oil through the injector holes and test again.

- 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:

Tighten the head bolts and nuts evenly in the correct sequence as shown in fig. 7.2.2A. Torque to 57.8 to 61.5 ft. lbs. (78.5 to 83.4 N.M.) on the V2203 engine and 54.2 to 61.5 ft. lbs. (73.5 to 83.4 N.M.) on the S2800B engine.

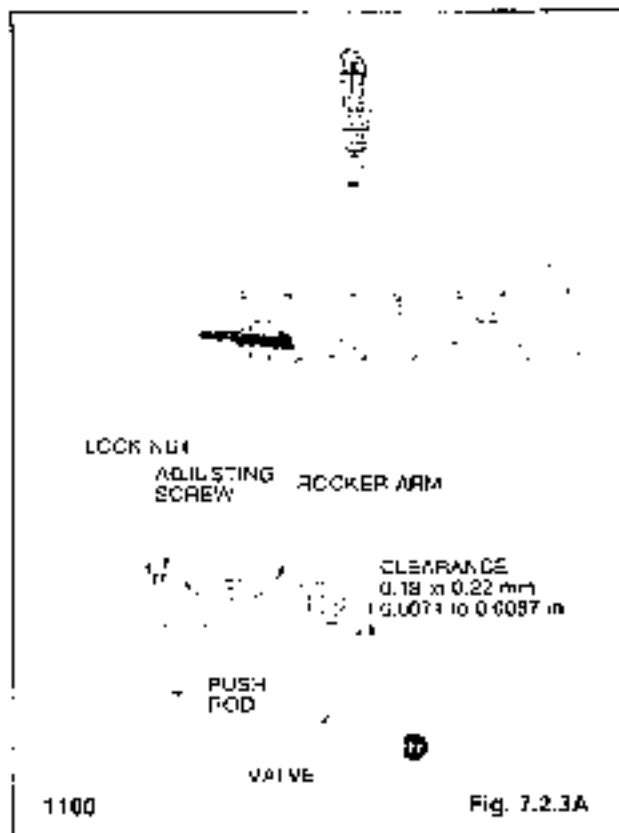
When overhauling the engine, replace the gasket with a new one. Apply engine oil to each nut and bolt and torque in the correct sequence as shown in fig. 7.2.2A. Retighten the nuts after running the engine for 30 minutes.



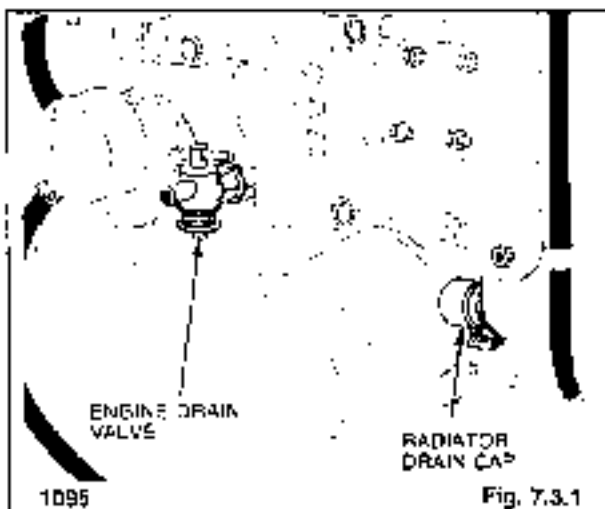
7.2.3 Valve Adjustment:

Measure the clearance with a feeler gauge after aligning each cylinder with top dead center of compression. Align the (TC) mark on the flywheel with the timing check window of the flywheel housing (Fig. 7.2.3A).

Adjust the valves in firing order sequence.



To fill the cooling system: close the drain valve on the engine block (Fig. 7.3.1) and refill the radiator drain plug. Fill the radiator with a 50-50 mixture of ethylene glycol and water. Refill the radiator cap.



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 build up of debris. Repair any damage and if necessary flush the radiator with compressed air to remove dirt buildup.

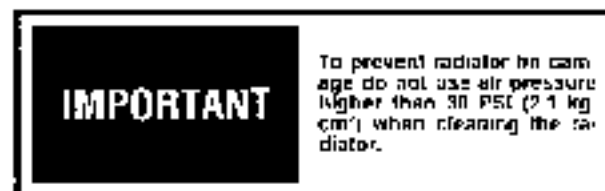
7.3 COOLING SYSTEM

7.3.1 Adding Fluid:

The engine cooling system fluid is a 50-50 mixture of ethylene glycol and water for cold weather protection.



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).

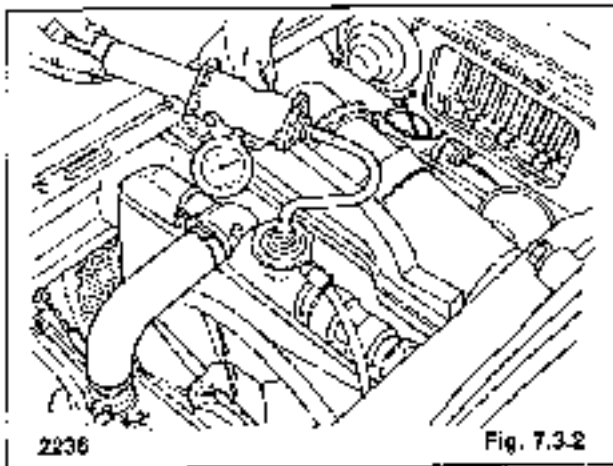


Test the radiator for leaks as follows:

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.

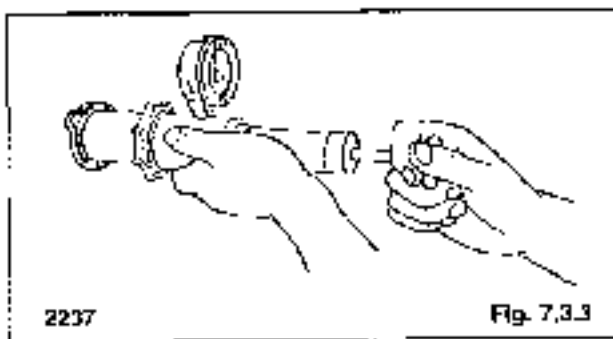


4. Attach a radiator tester and increase the pressure to 12.8 lbs./in.² (0.9 kg/cm²). Fig. 7.3.2
5. Check for leaks.



7.3.3 Radiator Cap — Pressure Test:

1. Attach a radiator tester to the radiator cap (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 (0.3 kg/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

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Fig. 7.3.4A

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.

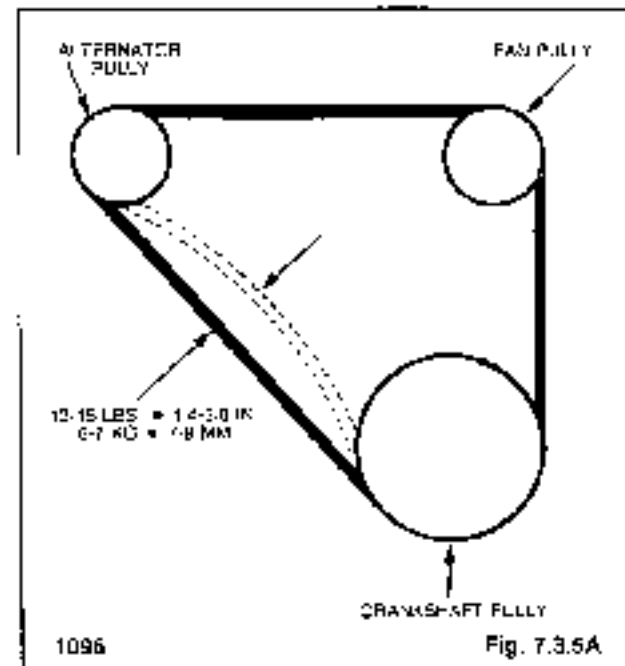
Replace the thermostat if it fails to open at the specified temperature.

Start to open 177-182°F (80.5-83.5°C)

Fully open 203°F (95°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).

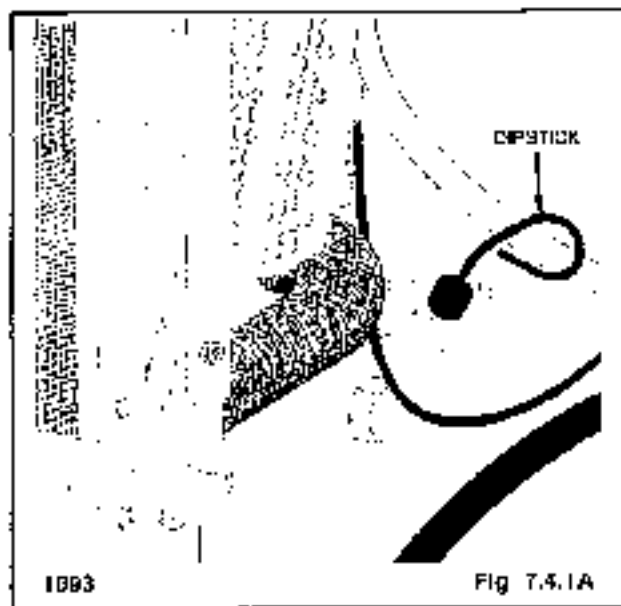


7.4 LUBRICATION SYSTEM

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 S.E.C.C.



7.4.2 Replace Engine Oil and Filter:

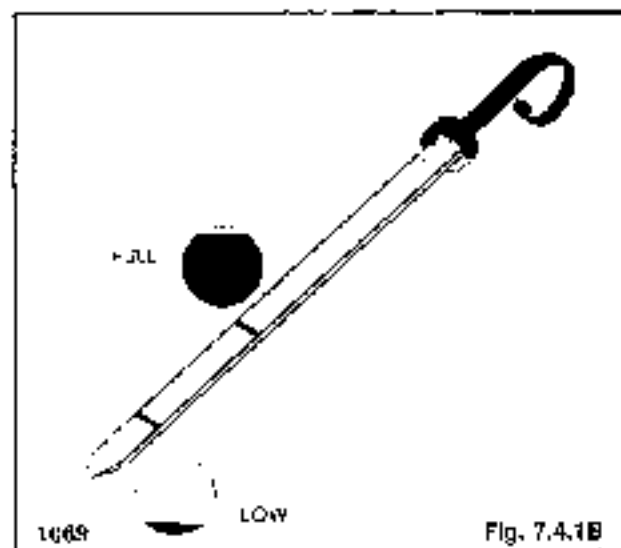
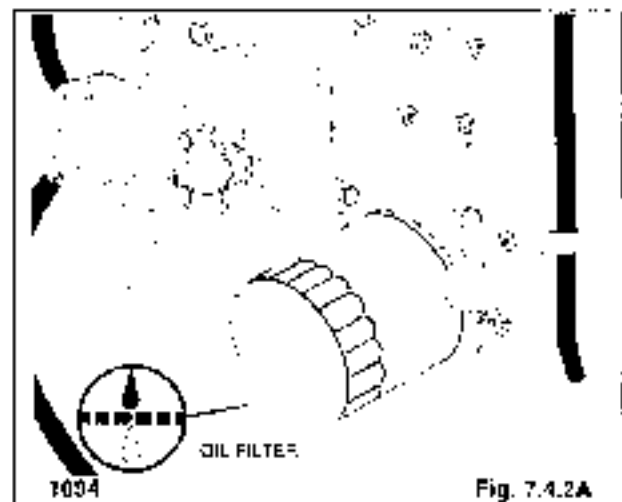
Operate the engine until warm, approx. 5 minutes. Stop the engine.

Remove the oil drain plug located at the bottom of the oil pan.

Remove the oil filter (Fig. 7.4.2A). Clean the face flanging 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 S.E.C.C. 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.

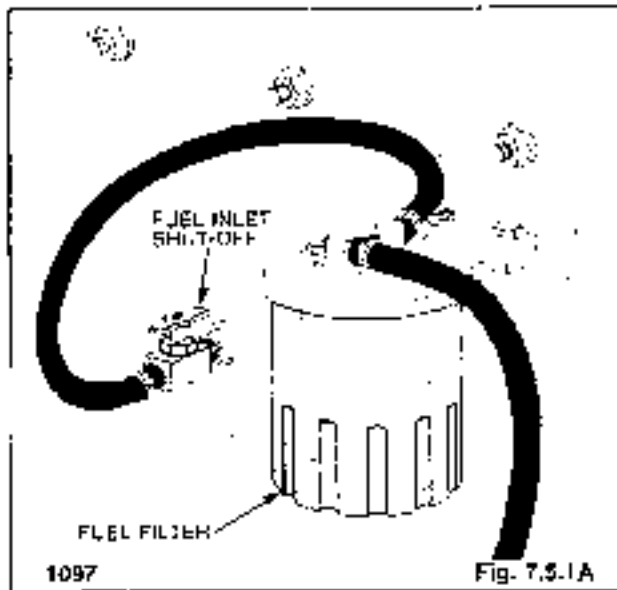


7.5 FUEL SYSTEM

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.

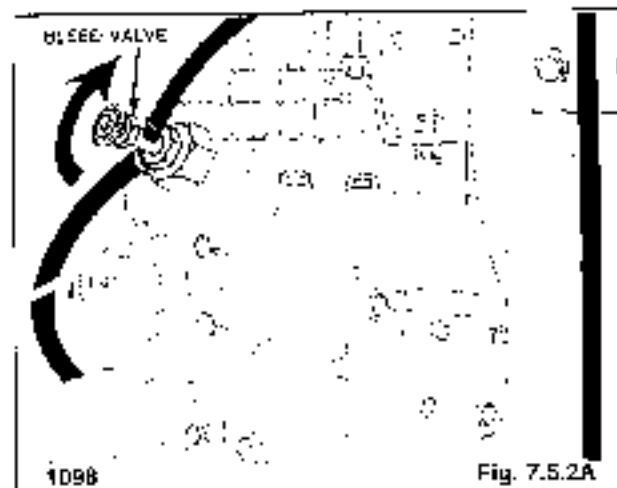
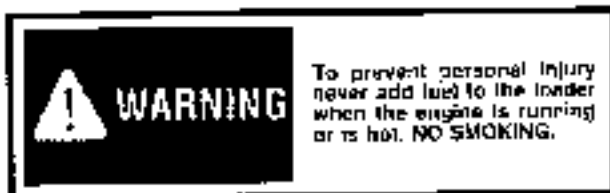
To replace the filter, close the fuel inlet line shut-off located on the side of the fuel tank (Fig. 7.5.1A). Remove the filter element (Fig. 7.5.1A). Lubricate the seal on the new filter and install the filter hand tight. Open the fuel inlet shut-off. It may be necessary to remove air from the fuel system after changing the filter element.



7.5.2 Removing Air from Fuel System:

Air must be removed from the fuel system 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) or top of the injector pump. Turn the engine over with the starter. When the engine starts and runs smoothly, close the valve.



7.6 AIR INTAKE SYSTEM

7.6.1 Air Filter Maintenance:

Daily Maintenance:

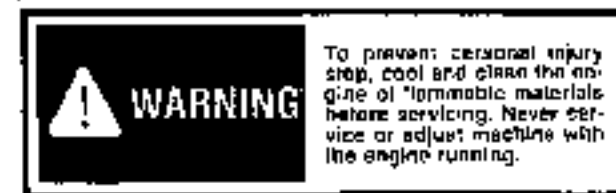
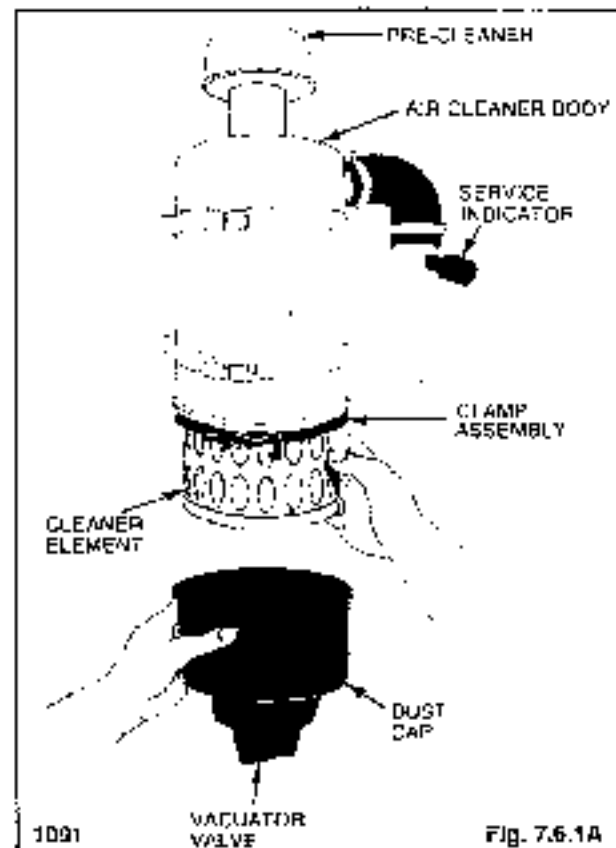
Inspect the air cleaner service indicator (Fig. 7.6.1A) daily. If the indicator element shows red the filter element must be replaced.

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 clear 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.



7 ENGINE

7.7.1 Specifications

General Specifications:

	T183HD	T233HD
Engine model	V2205	S2800B
Number of cylinders	4	6
Horsepower	52 HP (38.6 Kw)	58.5 HP (43.6 Kw)
Bore x stroke	3.5 x 3.62 in. (87 x 92 mm)	3.35 x 3.23 in. (85 x 82 mm)
Displacement	133.5 cu. in. (2187 cc)	170.3 cu. in. (2791 cc)
Max. torque	11.5 ft. lbs. 1600 (15.0 kgf.m.)	13.5 ft. lbs. 1200 (18.7 kgf.m.)
Compression ratio	26.1	21.1
Engine compression	398-441 PSI (28-31 kgf/cm ²)	441 PSI (31 kgf/cm ²)
Maximum high idle	2600	2800
Low idle	675 ± 25	875 ± 25
Firing order	1-3-4-2	1-5-3-6-2-4
Cylinder arrangement	In-line vertical	In-line vertical
Valve arrangement	Overhead	Overhead
Muffler	Vertical (spark arrestor)	Vertical (spark arrestor)

Cylinder Liners	T183HD	T233HD
I.D. of cylinder (in) standard	3.3465-3.3473 in. (85.000-85.022 mm)	3.3165-3.3173 in. (85.000-85.022 mm)
maximum	-0.0059 in. (-0.15 mm)	-0.0059 in. (-0.15 mm)

Cylinder Head	T183HD	T233HD
Distortion (head ward)	0.0019 in. (0.05 mm) * 3.9370 in. (100 mm)	
Thickness of gasket	0.0433-0.0492 in. (1.10-1.25 mm)	0.3539-0.0602 in. (1.37-1.53 mm)
Thickness of gasket shims	0.0079 in. (0.2 mm)	
Top clearance	0.0237-0.0315 in. (0.6-0.8 mm) * 0.0276-0.0364 in. (0.7-0.9 mm)	
Cylinder head bolt & nut torque	54.2-57.0 ft. lbs. (73.5-78.4 N.M.)	54.2-61.5 ft. lbs. (73.5-83.4 N.M.)

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Valves		T183HD	T233HD
Valve seat width		0.0627 in. (2.1 mm)	0.0635 in. (2.12 mm)
Valve seat angle		45°	
O.D. of valve stems (intake, exhaust)		0.3124-0.3140 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 stems and guides	standard	0.0016-0.0028 in. (0.04-0.07 mm)	
	maximum	0.0039 in. (0.1 mm)	
Valve recessing	standard	0.256-0.0335 in. (3.85-0.85 mm)	0.0433-0.0512 in. (1.1-1.3 mm)
	Maximum	0.0459 in. (1.15 mm)	0.0030 in. (1.6 mm)
Valve clearance (intake, exhaust)	cold	0.00157-0.00278 in. (0.040-0.070 mm)	0.0071-0.0087 in. (0.18-0.22 mm)

Valve Springs		T183HD	T233HD
Free length	standard	1.6417-1.6614 in. (41.7-42.2 mm)	
	Minimum	1.6220 in. (41.2 mm)	
Fitted length		1.3839 in. (35.15 mm)	
Load to compress	standard	26.5 lbs. (12 kg)	
To fitted length	minimum	22.5 lbs. (10.2 kg)	
Squareness		0.0094 in. (1.0 mm)	

Valve Rocker Arms		T183HD	T233HD
O.D. of rocker arm shafts		0.5501-0.5506 in. (13.970-13.984 mm)	
I.D. of rocker arm bushings		0.5513-0.5523 in. (14.002-14.043 mm)	
Clearance between rocker arm shafts and bushings	standard	0.0007-0.0028 in. (0.018-0.070 mm)	
	maximum	0.0059 in. (0.15 mm)	
Adjustment of compression release		0.0295-0.0443 in. (0.750-1.125 mm)	

CAMSHAFT		T183HD	T233HD
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 journals and bearings	standard	0.0020-0.0036 in. (0.052-0.091 mm)	
	maximum	0.0059 in. (0.15 mm)	
Alignment of camshaft		0.0020 in. (0.05 mm) 0.0031 in. (0.08 mm)	
Cam height	standard (Intake)	1.30957 in. (33.263 mm)	1.3134 in. (33.36 mm)
	minimum	1.3079 in. (33.22 mm)	1.3114 in. (33.31 mm)
	Standard (Exhaust)	1.317 in. (33.4 mm)	1.3194 in. (33.36 mm)
	Minimum	1.3157 in. (33.42 mm)	1.3114 in. (33.31 mm)
Gear backlash	Standard	0.0015-0.0043 in. (0.4-1.1 mm)	0.0017-0.0045 in. (0.42-1.15 mm)
	maximum	0.0059 in. (0.15 mm)	
PISTON RINGS			
(Top ring - 2nd ring)	standard	0.0115-0.0177 in. (0.30-0.45 mm)	
	maximum	0.0492 in. (1.25 mm)	
Ring gap (Oil ring)	standard	0.0098-0.0177 in. (0.25-0.45 mm)	
	maximum	0.0492 in. (1.25 mm)	
Side clearance of ring in groove	(Top ring)		
	(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 and ring		0.0197 in. (0.5 mm)	
PISTONS			
I.D. of piston bosses	standard	0.9055-0.9050 in. (23.000-23.013 mm)	
	maximum	0.9076 in. (23.053 mm)	
O.D. of piston pin		0.9055-0.9059 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 pin and small end bushings	standard	0.0006-0.0015 in. (0.014-0.038 mm)	
	maximum	0.0059 in. (0.15 mm)	
Connecting rod alignment	standard	0.0008 in. (0.02 mm)	
	maximum	0.0020 in. (0.05 mm)	

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CRANKSHAFT		T183HD	T233HD
Crankshaft alignment	standard	0.003 in. (0.02 mm)	
	maximum	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 crankshaft journal and bearing 1	standard	0.0018-0.0046 in. (0.040-0.118 mm)	
	maximum	0.0079 in. (0.20 mm)	
Clearance between crankshaft journals and bearing 2	standard	0.0018-0.0041 in. (0.040-0.104 mm)	
	maximum	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 crankpins and bearings	standard	0.0014-0.0037 in. (0.035-0.093 mm)	
	maximum	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	Standard	0.0059-0.0122 in. (0.15-0.31 mm)	
	maximum	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 ²)
Fuel tightness of nozzle valve seal	Dry nozzle at 1848.6-1920.9 lb./sq. in. (130-140 kgf/cm ²)

INJECTION PUMP		T183HD	T233HD
Fuel tightness of plunger	Standard	8 seconds or more; initial pressure from 8532.0-1110.0 lb./sq. in. (600-800 kgf/cm ²)	
	minimum	4 seconds or less	
Fuel tightness of delivery valve	Standard	10 seconds or more; initial pressure from 1422 lb./sq. in. (100 kgf/cm ²)	
	minimum	5 seconds or less	
Injection timing		17°-19° before TDC	25°-26° before TDC

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OIL PUMP		T183HD	T233HD
Oil pressure (Normal running)	standard	42.7-64.0 lb./sq. in. (3.0-4.5 kg/cm ²)	
	minimum	35.6 lb./sq. in. (2.5 kg/cm ²)	
Rotor lobe clearance	standard	0.0016-0.0051 in. (0.04-0.13 mm)	0.0030-0.0063 in. (0.10-0.16 mm)
	maximum	0.0079 in. (0.20 mm)	
ROTOR TYPE			
Radial clearance between outer rotor and pump body	std.	0.0043-0.0075 in. (0.11-0.19 mm)	
	max.	0.0098 in. (0.25 mm)	
End clearance between rotor and cover	std.	0.0041-0.0059 in. (0.105-0.150 mm)	
	max.	0.0075 in. (0.2 mm)	

RADIATOR		
Opening pressure of cap		12.8 lb./sq. in. (9.9 kg/cm ²)
Test pressure		12.8 lb./sq. in. (9.9 kg/cm ²)

THERMOSTAT		
Opening temperature	(beginning)	176.9°F 162.3°F (80.5°C-83.5°C)
	(full-open)	203°F (95°C)
Distance of lift		0.3153 in. (8 mm)

FANBELT		
Belt sag under load of 13.2-15.4 lb. (6-7 kg)		0.2756-0.3542 in. (7-9 mm)

ALTERNATOR		T183HD	T233HD
Output current		35 A / 14 V / 4000 rpm	25 A / 14 V / 4000 rpm
Total resistance of rotor coil, measured between terminal "F" and "E"	std.	6 Ω	
	max.	10 Ω	
Brush length	std.	0.6102 in. (15.5 mm)	
	min.	0.4055 in. (10.3 mm)	

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REGULATOR	T183HD	T233HD
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	0Ω	
"IG" and "F" with contacts	Approx. 11Ω	
"L" and "E" with open contacts	0Ω	
"L" and "E" with contacts	Approx. 100Ω	
"N" and "E"	Approx. 23Ω	
"B" and "E" with open contacts	Infinity	
"B" and "L" with contacts	0Ω	
Point gap	0.0118-0.0177 in. (0.3-0.45 mm)	

STARTER MOTOR		
No-load test	Current	50 A or less
	Voltage	11.5 V
	Speed	5500 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)
	max.	0.0379 in. (0.9 mm)
Brush length	std.	0.7480 in. (19 mm)
	min.	0.5000 in. (12.7 mm)

GLOW PLUG	
Resistance	1.0-1.2 Ω

CIRCUIT BREAKER	
Rating	40 AMP 50 AMP

7.7.2 Torque Specifications.




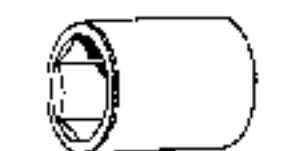
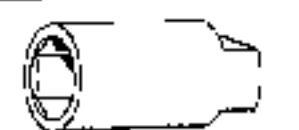
Bolt Torques

Material Grade	Standard Bolt	Special Bolt	
	SS41, S20C	S43C	S48C (Refined)
Nominal Dia.			SCR3, SCM3 (Refined)
M 6	7.5 - 9.8 N.m. 0.80 - 0.95 kgf/m 5.8 - 5.9 lb. ft.	9.8 - 11.2 N.m. 1.00 - 1.15 kgf/m 7.2 - 8.2 lb. ft.	12.3 - 14.2 N.m. 1.25 - 1.45 kgf/m 9.0 - 10.5 lb. ft.
M 8	17.7 - 20.8 N.m. 1.80 - 2.10 kgf/m 13.0 - 15.2 lb. ft.	23.5 - 27.5 N.m. 2.40 - 2.90 kgf/m 17.4 - 20.3 lb. ft.	29.4 - 34.3 lb. ft. 3.00 - 3.50 kgf/m 21.7 - 25.5 lb. ft.
M10	39.2 - 45.1 N.m. 4.00 - 4.60 kgf/m 28.9 - 33.3 lb. ft.	48.0 - 55.9 N.m. 4.90 - 5.70 kgf/m 35.4 - 41.2 lb. ft.	60.8 - 70.8 N.m. 6.20 - 7.20 kgf/m 44.8 - 52.1 lb. ft.
M 12	62.8 - 72.6 N.m. 6.40 - 7.40 kgf/m 46.3 - 53.5 lb. ft.	77.5 - 90.2 N.m. 7.90 - 9.20 kgf/m 57.1 - 66.5 lb. ft.	103.0 - 117.7 lb. ft. 10.50 - 12.00 kgf/m 75.9 - 86.0 lb. ft.
M14	107.9 - 125.5 N.m. 11.00 - 12.80 kgf/m 79.8 - 92.6 lb. ft.	123.0 - 147.1 N.m. 12.60 - 15.00 kgf/m 91.1 - 108.5 lb. ft.	166.7 - 196.3 N.m. 17.00 - 20.00 kgf/m 123.0 - 144.7 lb. ft.
M16	166.7 - 191.2 N.m. 17.00 - 19.50 kgf/m 123.0 - 141.0 lb. ft.	196.1 - 225.5 N.m. 20.00 - 23.00 kgf/m 144.7 - 166.4 lb. ft.	259.9 - 304.0 N.m. 26.50 - 31.00 kgf/m 191.7 - 224.2 lb. ft.
M18	246.2 - 284.4 N.m. 25.00 - 29.00 kgf/m 180.0 - 209.8 lb. ft.	274.6 - 318.7 N.m. 28.00 - 32.50 kgf/m 202.5 - 235.1 lb. ft.	343.2 - 402.0 N.m. 35.00 - 41.00 kgf/m 253.2 - 296.5 lb. ft.
M20	333.4 - 392.2 N.m. 34.00 - 40.00 kgf/m 245.9 - 289.3 lb. ft.	367.7 - 431.5 N.m. 37.50 - 44.00 kgf/m 271.2 - 318.2 lb. ft.	490.3 - 568.7 N.m. 50.00 - 58.00 kgf/m 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
07916-30042-01		<p>Dry Liner Puller — Used for removing and installing the dry liner of the engine.</p> <p>Consists of: 304742 (64mm); 304743 (66mm); 304744 (75mm); 304745 (70mm); 304746 (82mm); 304747 (105mm); Pumping Plates, 304748 Installing Plate.</p>	All Models
07309-30202-01		<p>Diesel Engine Compression Tester — Used to measure diesel engine compression and diagnosis of need for major overhaul.</p>	All Models
07916-30820-01		<p>Crankshaft Nut Socket — Used to take off and fix the crankshaft nut (40mm)</p>	All Models
07916-30640-01		<p>Nozzle Remover Socket — Used to unfasten and to fasten the screw-type nozzle holders.</p>	All Models
70090-01125-01		<p>Nozzle Disassembly Socket — Used in place of a vice for disassembly and repair of nozzles.</p>	All Models

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7.7.4 Trouble Shooting:

ENGINE

Condition	Possible Causes
Engine Does Not Develop Full Power	<ol style="list-style-type: none"> 1. Clogged air cleaner. 2. Fuel line obstructed. 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Improper injection timing. 2. Air in injection pump. 3. Improper governor adjustment.
Engine Knocks	<ol style="list-style-type: none"> 1. Diluted or thin oil. 2. Inefficient 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.

Condition	Possible Causes
Engine Knocks	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.
Oil Pressure Warning Light Fails to Operate	<ul style="list-style-type: none"> 1. Bulb burned out. 2. Oil pressure sensor is faulty. 3. Warning light circuit faulty.
Excessive Oil Consumption	<ul style="list-style-type: none"> 1. Engine oil level too high. 2. Leakage in the cylinder head gasket. 3. Oil loss past the pistons 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 seats. 7. Leakage past oil seals and gaskets. 8. External oil leaks from the engine.
Engine Overheats	<ul style="list-style-type: none"> 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.

Condition	Possible Causes
Engine Overheats	<ol style="list-style-type: none"> 12. Improperly installed cylinder head gasket. 13. Rust and/or scale clogged water ports. 14. Extended engine idling.
Excessive Fuel Consumption	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Faulty temperature sender. 2. Faulty thermostat. 3. Faulty temperature gauge.
Excessive Exhaust Smoke	<ol style="list-style-type: none"> 1. Air cleaner dirty or restricted. 2. Excessive fuel delivery. 3. Low cylinder pressure.
Excessive Oil Consumption	<ol style="list-style-type: none"> 1. Engine oil level too high. 2. External oil leaks from engine. 3. Worn valves, valve guides or seats. 4. Head gasket not sealing. 5. Oil loss past the pistons and rings.
Engine Stops While Operating	<ol style="list-style-type: none"> 1. Lack of fuel in the fuel tank. 2. Clogged fuel filter. 3. Air mixed in the fuel system. 4. Faulty component.
Undesirable Exhaust (white or pale)	<ol style="list-style-type: none"> 1. Excess engine oil. 2. Improper lubricating oil viscosity. 3. Faulty injection timing.
Undesirable Exhaust Color (black or light grey)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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.

Condition	Possible Causes
ENGINE DOES NOT START	<ol style="list-style-type: none"> 7. Glow plug not heating. 8. Improper lubricating oil viscosity. 9. Clogged air cleaner. 10. Breaking down of fusible link wire. 11. Faulty starter motor. 12. Main shift lever is not in the neutral position.

COOLING SYSTEM

Condition	Possible Causes
HIGH TEMPERATURE INDICATION — OVERHEATING	<ol style="list-style-type: none"> 1. Coolant level low. 2. Fan belt loose. 3. Radiator hose(s) collapsed. 4. Radiator blocked in 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 hoses clogged. 13. Cooling system clogged. 14. Casting flash in cooling passages. 15. Brakes dragging. 16. Excessive engine friction. 17. Antifreeze concentration too high, over 58%. 18. Missing air seals. 19. Faulty gauge or sending unit. 20. Loss of coolant flow caused by leakage or foaming.
LOW TEMPERATURE INDICATION — UNDERCOOLING	<ol style="list-style-type: none"> 1. Thermostat stuck open. 2. Faulty gauge or sending unit.
COOLANT LOSS — BOIL-OVER	<p>Refer to Engine Overheating Causes. In addition to the following:</p> <ol style="list-style-type: none"> 1. Overfilled cooling system.

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Condition	Possible Causes
COOLANT LOSS — DIL OVER	<ol style="list-style-type: none"> 2. Quick shutdown after hard (hot) run 3. Air in system resulting in occasional "burping" of coolant. 4. Insufficient anti-freeze in mixture allowing coolant boiling point to be too low. 5. Anti-freeze deteriorated because of age or contamination. 6. Leaks due to loose hose clamps, loose nuts, bolts, drain valve, faulty hoses, or defective radiator 7. Faulty head gasket. 8. Cracked head, manifold, or block.
COOLANT ENTRY INTO CRANKCASE OR CYLINDER	<ol style="list-style-type: none"> 1. Faulty head gasket. 2. Crack in head, manifold, or block. 3. Faulty cylinder liner O-Ring.
NOISE	<ol style="list-style-type: none"> 1. Fan contacting shroud. 2. Loose water pump impeller. 3. Glazed fan belt. 4. Loose fan belt. 5. Rough surface on drive pulley. 6. Water pump bearing worn. 7. Belt alignment.
TEMPERATURE LAMP ON OR GAUGE READS HOT BUT TEMPERATURE IS OK	<ol style="list-style-type: none"> 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.

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DIESEL FUEL SYSTEMS

CONDITION	CAUSE	REMEDY
Fuel not reaching injection pump	<ol style="list-style-type: none"> 1. Fuel shut-off valve closed 2. Restricted fuel filters 3. Air in system 4. Fuel leakage 	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Low cranking speed 2. Incorrect throttle adjustment 3. Incorrect pump timing 4. Fuel leakage 5. Faulty injectors 6. Low compression 	<ol style="list-style-type: none"> 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 injector trouble shooting 6. Check the engine compression
Engine hard to start	<ol style="list-style-type: none"> 1. Low cranking speed 2. Incorrect pump timing 3. Restricted fuel filter 4. Contaminated fuel 5. Low compression 6. Air in system 	<ol style="list-style-type: none"> 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 starts and stops	<ol style="list-style-type: none"> 1. Fuel starvation 2. Contaminated fuel 3. Restricted air intake 4. Engine overheating 5. Air in system 	<ol style="list-style-type: none"> 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)	<ol style="list-style-type: none"> 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 	<ol style="list-style-type: none"> 1. Check the injection lines and connectors for leakage 2. Check and flush clean restricted 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

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CONDITION	CAUSE	REMEDY
Engine does not develop full power or speed	<ol style="list-style-type: none"> 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 	<ol style="list-style-type: none"> 1. Check for insufficient throttle 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
Engine emits black smoke	<ol style="list-style-type: none"> 1. Restricted air intake 2. Engine overheating 3. Incorrect timing 4. Faulty injectors 5. Low compression 6. Incorrect engine timing 	<ol style="list-style-type: none"> 1. Check for a restricted air intake 2. Check cooling system 3. Check the pump timing 4. See injector trouble shooting 5. Check the engine compression 6. Check the engine valves
Pump fails to deliver fuel to all injectors	<ol style="list-style-type: none"> 1. Blocked fuel lines to pump 2. Air in fuel lines to injectors 3. Control rod seized in OFF position 	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Air in fuel line to injector 2. Plunger spring broken 3. Plunger seized 4. Delivery valve seized 5. Badly scored plunger and barrel 	<ol style="list-style-type: none"> 1. Bleed fuel line 2. Replace spring 3. Repair or replace barrel and plunger assembly 4. Repair or replace delivery valve 5. Replace barrel and plunger assembly
Governor fails to maintain maximum or minimum no-load fuel delivery	<ol style="list-style-type: none"> 1. Control spring broken 2. Governor weights seized 3. Governor weight carrier broken 4. Thrust pad seized 5. Cross-shaft ball broken or missing 6. Pump link spring broken 	<ol style="list-style-type: none"> 1. Replace control spring 2. Repair or replace weight assembly and/or carrier 3. Replace weight assembly 4. Replace thrust pad and/or camshaft 5. Replace ball 6. Replace spring

FUEL INJECTORS

CONDITION	CAUSE	REMEDY
Nozzle does not "buzz" while injecting	<ol style="list-style-type: none"> 1. Needle valve stuck 2. Leakage 3. Nozzle damaged 	<ol style="list-style-type: none"> 1. Check nozzle valve is clean and not binding 2. Check valve seal is not leaking 3. Examine nozzle retaining cap for damage
Nozzle leak-back	<ol style="list-style-type: none"> 1. Needle valve wear 2. Blocked nozzle assembly 3. Loose nozzle retaining nut 	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Incorrectly adjusted nozzle retaining nut 2. Damaged nozzle or seized needle valve 3. Blocked nozzle orifice 	<ol style="list-style-type: none"> 1. Check adjusting nut for looseness and reset 2. Replace nozzle assembly 3. Check nozzle orifice for carbon or foreign matter. Flush clean or replace
Nozzle seat leakage	<ol style="list-style-type: none"> 1. Nozzle incorrectly seated 2. Sticking or binding needle valve 	<ol style="list-style-type: none"> 1. Check for carbon or foreign matter on faces of nozzle or nozzle holder 2. Repair or replace nozzle assembly
Spray pattern distorted	<ol style="list-style-type: none"> 1. Obstructed needle valve 2. Obstructed needle valve orifice 3. Damaged nozzle or needle valve 	<ol style="list-style-type: none"> 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

- 8.1 Preventative Maintenance Schedule
- 8.2 50 Hour Service Check
- 8.3 Specifications
- 8.4 Torque Specifications
- 8.5 Decals

8 MAINTENANCE / SPECIFICATIONS

8.1 PREVENTATIVE MAINTENANCE SERVICE SCHEDULE

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.					
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 locks, parking brake, steering and foot pedal locks, safety treads, front shield, cab side screens and neutral start switch. If necessary lubricate foot pedal and steering control linkages, springs and shafts with WD40. If necessary repair or replace.					
Decals	Check for damaged safety or instruction decals (see section 8.5). If necessary replace.					
Lubrication	Grease all fittings until excess shows.					
Engine Oil	Replace engine oil. Use 10W30 API Classification SE/CD oil. Change every 75 hrs.					
Engine Oil Filter	Replace engine oil filter. Initial change only. Change every 150 hours.					
Hydraulic Oil Filter	Change hydraulic oil filter element. Initial change only. Change every 150 hrs.					
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 foot pedal lock springs, shaft and linkage with WD40.					
50 Hour Service	Perform complete 50 hour service (see 8.2). Repeat every 150 hours.					

8 MAINTENANCE / SPECIFICATIONS

ITEM	SERVICE REQUIRED	8 HOURS	50 HOURS	150 HOURS	400 HOURS	1000 HOURS
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. Replace every 150 hours.					
Preventative Maintenance Service Check	This is recommended as a preventative maintenance procedure that the 50 hour service be repeated every 150 hours. (See section 8.2).					
Engine Fuel Filter	Replace engine fuel filter. Replace every 400 hours.					
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/CD oil.					
Engine Cooling System	Drain, flush and refill. Use 50% mixture of ethylene glycol and water.					
Hydraulic Reservoir Filters	Remove and replace the two 100 micron suction elements in the oil reservoir.					

NOTE: For complete engine service details refer to the engine manufacturers service manual.

8 MAINTENANCE/SPECIFICATIONS

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 SF/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.

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 line(s) 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 R.P.M. Maximum no load high idle.

Kubota V2203 2950 R.P.M.
Kubota S230CB 2800 R.P.M.

1.10 Muffler

Check muffler for carbon and soot buildup and plugging. If necessary clean.

IMPORTANT

Keep the rear door closed except for servicing. Make sure the door is closed and latched before operating the loader.



WARNING

To avoid personal injury stop the engine, engage the parking brake and lower the boom arms and check that the foot pedals are locked before you get off the loader.

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. Torque the cartridge case 30 ft. lbs. (40 N.M.) or one-half to three quarters turn.

2.2 Hydraulic Oil Level

Open the bottom shut off cock on the oil reservoir. If oil is apparent the level is satisfactory.

If additional oil is required use only 10W30 AP classification SF/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 & Motors, Leakage

Inspect pumps and motors for leak.

2.7 Oil Cooler

Inspect the oil cooler for leaks, line damage or clogged with dirt. If necessary flush lines with compressed air.



WARNING

To avoid personal injury: Never repair or lighten 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 SF/CD oil.

3.2 Drive Chain Tension and Condition

Check drive chains for any sign of wear or damage. Check lubrication oil or housing for signs of contamination.

8 MAINTENANCE/SPECIFICATIONS

3.3 Hydrostatic Motor Mounting Bolts.
Check torque 20-85 ft. lbs. (109-115 N.M.).

3.4 Axle Bearing End Play
Axle bearings are preloaded and must have no end play. Inspect and adjust if necessary.

3.5 Idler Sprocket Bearing End Play:
The idler sprockets are preloaded and must have no end play. Inspect and adjust if necessary.

3.6 Transmission Housing Mounting Bolts:
Check torque 70 ft. lbs. (95 N.M.).

4 Controls and Safety Equipment

4.1 Control Levers, Operator 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 with WD40.

4.2 Foot Pedals, Operation and Linkage.
Check that the foot pedals operate freely without binding. Ensure pedals lock with seat bar up. Lubricate linkage with WD40.

4.3 Engine Throttle Control.
Check that the throttle control operates freely without binding or sacking off due to vibration.

4.4 Parking Brake
Check that the parking brake engages and completely disengages.

4.5 Boom Locks.
Check that the boom locks operate without binding.

NOTE: Ensure the boom locks are fully retracted before raising or lowering the boom.

4.6 Quick-Tach, Operation & Linkage.
Ensure the quick-tach linkage operates smoothly without binding and the safety locks engage completely.

4.7 Neutral Start Switch.
Lubricate the ball on the neutral start switch to prevent binding. Use a silicon based lubricant.

4.8 Seat Bar.
Check that seat bar operates freely without binding. Lubricate linkage with silicon based lubricant.

4.9 Seat Belt.
Check seat belt condition. If necessary replace.

5 Electrical

5.1 Battery Electrolyte Level.
Check electrolyte level. If necessary add distilled water.

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's 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, gauges, warning devices, pre-heat indicator, work lights, neutral & over-ride start switches and all optional equipment to ensure they are operating correctly.

6 Grease/Lubrication

Lubricate the following points with a good quality grease. Numbers marked () indicate the number of fillings at each location.

Rear Drum Fivots (2)
Boom Cylinder Bushings (4)
Sprocket Cylinder Bushings (4) on T233-D 12;
Engine Universal Joint (2)
Boom Locks (2)
Quick-Tach Pivot (2) (T173-T239 only)

7 General

7.1 Tire Pressure:
Check tire pressure and if necessary inflate to the following pressures.

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.).

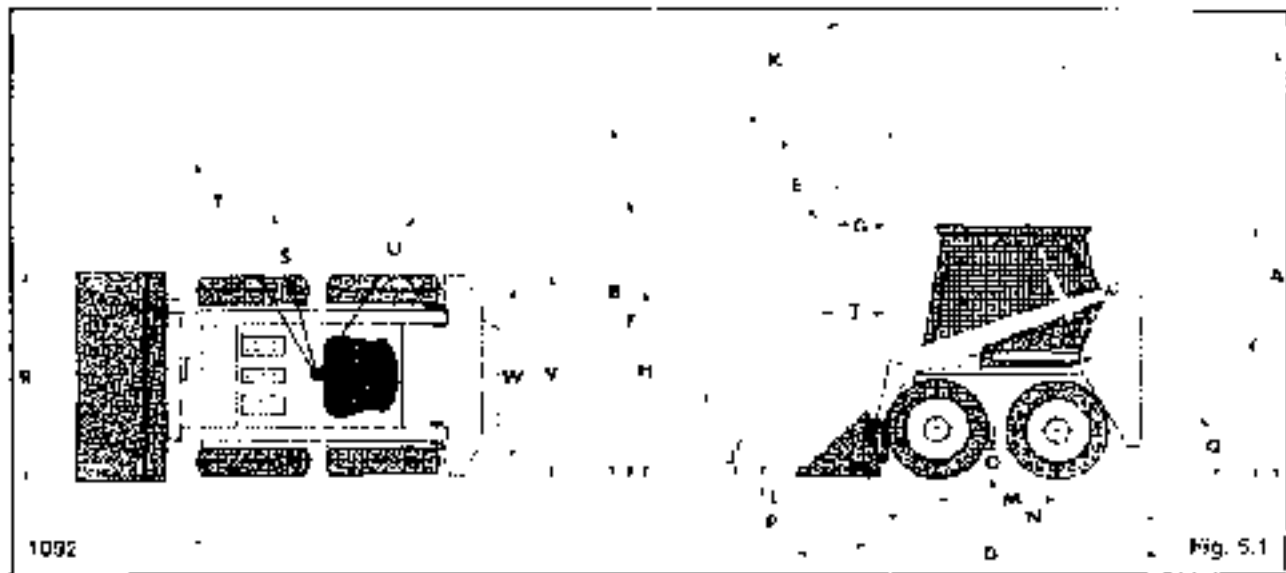
7.3 Condition of Cab
Inspect both the seat and seat belt. Ensure all safety and instruction decals are in place. Inspect sound insulation, side windows and door operation for machines equipped with cab enclosure kits.

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.

B MAINTENANCE/SPECIFICATIONS

LOADER SPECIFICATIONS:



Dimensions — B.1: (With Std. Tires & Dirt Bucket)

	T183HD	T233HD
A. Overall operating height	152.6" (3876 mm)	158" (4012 mm)
B. Height to hinge pin	118.6" (3012 mm)	124" (3150 mm)
C. Overall vehicle height	82" (2083 mm)	83" (2108 mm)
D. Overall length with bucket	140.3" (3563 mm)	145" (3685 mm)
E. Dump angle	27°	32°
F. Dump height	94.2" (2393 mm)	97" (2464 mm)
G. Reach — fully raised	29.2" (742 mm)	24.3" (617 mm)
H. Height at 45° dump angle	58.0" (1445 mm)	82.5" (2096 mm)
I. Reach at 45° dump angle	33.5" (851 mm)	24.6" (625 mm)
J. Maximum roll back at ground	28°	27°
K. Maximum roll back fully raised	34°	33°
M. Wheel base	39.6" (1006 mm)	42.6" (1082 mm)
N. Overall length less bucket	112" (2845 mm)	116.5" (2959 mm)
O. Ground clearance	7.8" (198 mm)	8" (229 mm)
P. Maximum grading angle — bucket	76°	90°
Q. Angle of departure	26°	28°
R. Bucket width	66" (1676 mm)	73" (1854 mm)
S. Clearance circle — front — less bucket	53.2" (1351 mm)	59" (1499 mm)
T. Clearance circle — front — with bucket	81.8" (2078 mm)	85" (2159 mm)
U. Clearance circle — rear	86.5" (2189 mm)	77" (1956 mm)
V. Overall width — less bucket	64" (1625 mm)	68.0" (1740 mm)
W. Tread	53" (1348 mm)	56.2" (1427 mm)

Operational:

	T183HD	T233HD
Rated operating capacity	1500 lbs. (681 kg)	2300 lbs. (1043 kg)
Operating weight	6900 lbs. (3130 kg)	7300 lbs. (3310 kg)
Shipping weight	6350 lbs. (2880 kg)	6700 lbs. (3033 kg)
Travel speed	7.3 m.p.h. (11.7 km/h)	7.7 m.p.h. (12.4 km/h)

8 MAINTENANCE/SPECIFICATIONS

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.

	T163HD	
Cylinders (double acting)	Lift	Tilt
Bore dia.	2.5 in.	3.0 in.
Rod dia.	1.5 in.	1.5 in.
	T223HD	
Cylinders (double acting)	Lift	Tilt
Bore dia.	3 in.	2.5 in.
Rod dia.	2 in.	1.5 in.
	*rated at 2150 P.S.I. (148 Bar)	

Engine:

Make and model	T163HD Kubota V2200
Cylinders	4
Cooling system	Liquid
Displacement	133.5 cu. in.
Horsepower	52 (38.8 Kw)
Torque	115 ft. lbs
	@ 1800 RPM
Fuel type	Diesel No. 2
Air cleaner	Replaceable Dry Cartridge with indicator
Maximum governed RPM (full load)	2950 RPM

Hydrostatic Transmission & Final Drive:

Pump type	Two in line, axial piston
Pump displacement	2.5 cu. in. (40.96 cc)
Motor type	Gerrler, torque motor
System relief setting	3750 P.S.I. (258.5 Bar)
Final drive	No. 100 roller chain running in an oil bath

Engine:

Make and model	T223HD Kubota S2800D
Cylinders	6
Cooling system	Liquid
Displacement	170.3 cu. in.
Horsepower	62.5 (46.6 Kw)
Torque	135 ft. lbs
	@ 1200 RPM
Fuel type	Diesel No. 20
Air cleaner	Replaceable Dry Cartridge with indicator
Maximum governed RPM (full load)	2800 RPM

Electrical:

	T163HD	T223HD
Alternator	35 amp	25 amp
Battery	12 v	12 v
Type	Group 33H	Group 30H
Cranking amps	520	520
Reserve capacity	165	165
Starter	12 v	12 v

Hydraulic System:

Pump type	Gear
Pump capacity T163HD	17 GPM (64.4 l/m) @ 2850 RPM
Pump capacity T223HD	16.2 GPM (61.4 l/m) @ 2800 RPM
Control valve	Series type with load on lift and detent on auxiliary
System relief pressure	2150 PSI (148 bar)
Filtration	10 micron
Hydraulic fluid	10W30 API Class. SE-CD

Tires:

	T163HD	T223HD
Standard	10.00 x 16.5, 6 ply 30-35 P.S.I. (207-241 KPa)	12.00 x 16.5, 8 ply 30-35 P.S.I. (207-241 KPa)

Fluid Capacities:

	T163HD	T223HD
Fuel tank	15 gal. (56.8 l)	16 gal. (60.3 l)
Final drive transmission	3.5 gal. (14 l)	3.5 gal. (14 l)
Hyd. Reservoir	16 gal. (60.3 l)	19 gal. (70.8 l)
Engine cooling system	3.2 gal. (14.5 l)	2.4 gal. (11.1 l)

8 MAINTENANCE/SPECIFICATIONS

8.2 TORQUE SPECIFICATIONS:

FOR NON CRITICAL AND NOT OTHERWISE MENTIONED APPLICATIONS, THE FOLLOWING GENERAL ASSEMBLY TORQUES WILL APPLY.

Loader:

Wheel nuts (32)	100-110 lbs. ft. (136-149 N.M.)
Idler flange nuts (18)	40-45 lbs. ft. (54-61 N.M.)
Rear axle flange mtg nuts (16)	75-80 lbs. ft. (102-109 N.M.)
Hydrostatic pump mtg bolts (4)	80-85 lbs. ft. (109-115 N.M.)
Hydrostatic motor mtg bolts (4)	80-85 lbs. ft. (109-115 N.M.)
Final drive hsg mtg bolts (20)	70 lbs. ft. (96 N.M.)

Hydraulic/Hydrostatic:

Gear pump section bolts	25-28 lbs. ft. (34-38 N.M.)
Piston pump section bolts	27-31 lbs. ft. (37-42 N.M.)
Torque motor section bolts	63 lbs. ft. (85 N.M.)
Hydraulic filter case	30 lbs. ft. (41 N.M.)

Bolts & Nuts

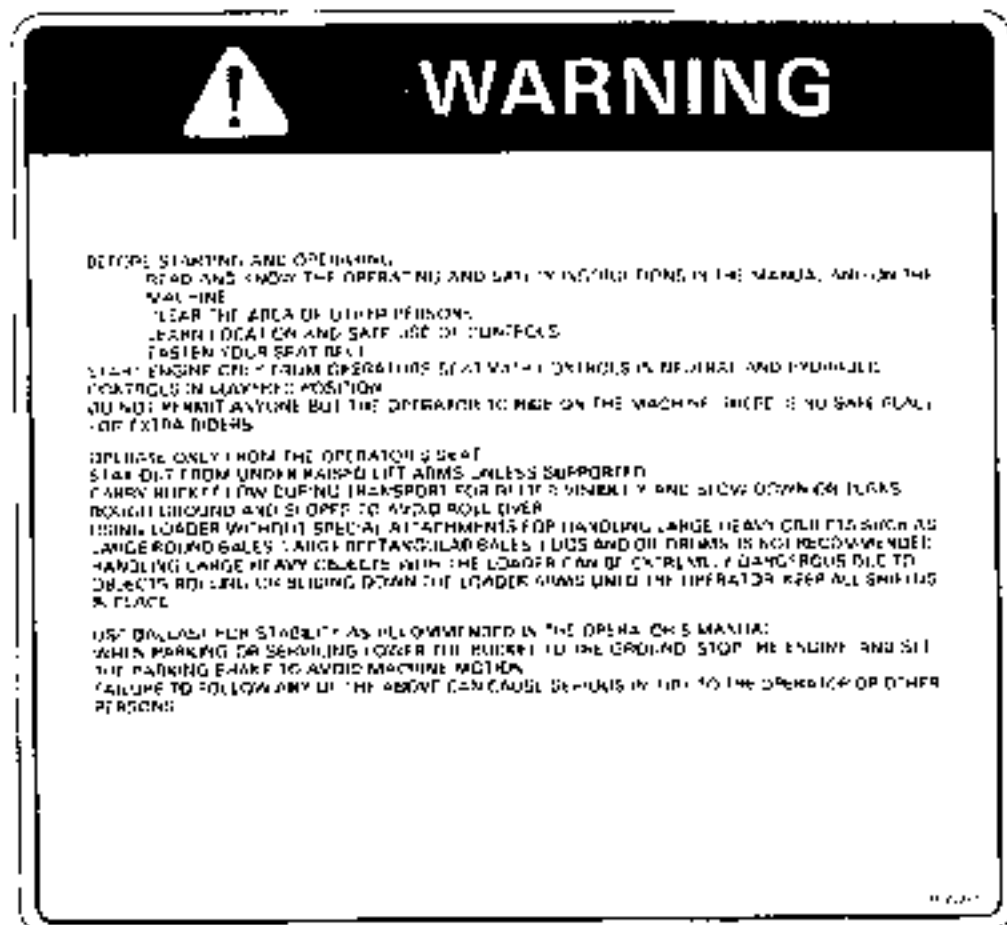
Torque

Lbs. ft. (N.M.)

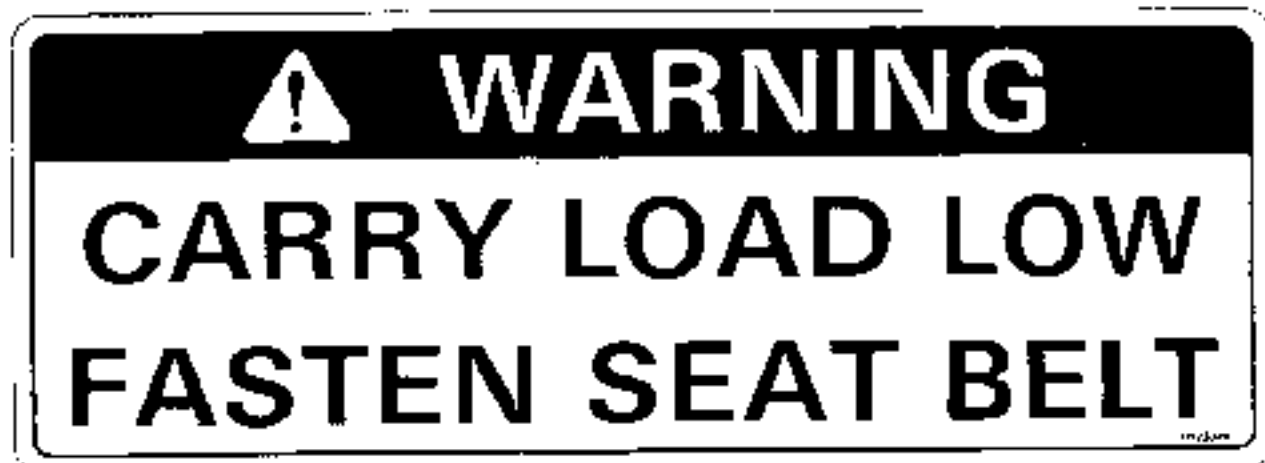
1/4-20	5-7 (6.7- 9.5)
5/16-18	12-15 (16- 20)
5/16-24	12-15 (16- 20)
3/8-15	17-22 (23- 30)
3/8-24	22-27 (30- 37)
7/16-14	30-35 (41- 47)
7/16-20	40-45 (54- 61)
1/2-13	45-50 (61- 68)
1/2-20	50-60 (68- 81)
5/16-17	50-70 (68- 95)
5/16-18	65-75 (88-102)
5/8-11	75-85 (102-115)
5/8-18	100-110 (136-139)

8 MAINTENANCE/SPECIFICATIONS

B.5 DECALS:



GENERAL INSTRUCTIONS
PART NO. — 21527
LOCATION — RIGHT HAND SIDE
OF ROPS PANEL



CARRY LOAD LOW
PART NO. — 80328
LOCATION — BACK OF LIFT ARM CROSS SECTION
FACING OPERATOR

8 MAINTENANCE/SPECIFICATIONS

8.5 DECALS:

SERVICE SCHEDULE				
EVERY 10 HOURS 1. ENGINE OIL CHECK LEVEL (see operators manual for correct oil specifications) 2. WATER PUMP/FLYER CHECK INDICATOR (check manual) indicator (check manual) 3. SAFETY Check for correct operation of P.E.P. and all safety devices (see operator's manual) and check for correct operation of all safety devices. 4. HYDRAULIC OIL CHECK LEVEL (see operators manual for oil specifications) 5. OIL TOLERANCE (check manual for specifications) 6. TIRES CHECK PRESSURE (see manual for correct tire pressure) (check manual for correct tire pressure) 7. WHEELS CHECK FOR CORRECT ALIGNMENT AND TIGHTENING (check manual for correct wheel alignment and tightening) 8. GENERAL Check for correct operation of all safety devices and for correct operation of all safety devices.	10	 		
EVERY 50 HOURS 1. ENGINE OIL CHANGE 2. HYDRAULIC OIL CHANGE 3. WHEELS CHECK FOR CORRECT ALIGNMENT AND TIGHTENING 4. SAFETY CHECK FOR CORRECT OPERATION OF ALL SAFETY DEVICES	50	 		
EVERY 100 HOURS 1. ENGINE OIL CHANGE 2. HYDRAULIC OIL CHANGE	100	 	EVERY 1000 HOURS 1. HYDRAULIC OIL CHANGE 2. ENGINE OIL CHANGE 3. ENGINE COOLING SYSTEM FLUSH 4. HYDRAULIC FILTERS CHANGE	1000

* FIRST CHANGE ONLY. SEE OWNERS AND OPERATORS MANUAL FOR COMPLETE SERVICE PROCEDURES, SPECS. AND CAPACITIES.

SERVICE SCHEDULE
 PART NO. — 23321
 LOCATION — ON FUEL TANK SIDE PANEL, OIL RESERVOIR

 AUX. CONTROL CZUSATZ STEUERUNG COMMANDE AUX CONTROL AUX.	 TILT	 FOOT PEDAL
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SEAT BELT
 PART NO. — 23569
 LOCATION — BACK
 SAFETY LAMP.

FOOT PEDAL
 PART NO. — 23301
 LOCATION — LEFT HAND
 LOWER CORNER ON SIDE
 PANEL OF F.O.P.S.

FASTEN SEAT BELT

8.5 DECALS:



JUMP START
PART NO. — 23325
LOCATION — BEHIND SEAT,
LEFT HAND CORNER



ENGINE
PART NO. 25324
LOCATION — ON RIGHT HAND SIDE
GUSSET OF LEFT ARM.



ROLL-OVER PROTECTIVE STRUCTURE
PART NO. — 23523
LOCATION — ON INSIDE LEFT HAND
OF LEFT ARM



SAFETY START
PART NO. — 23470
LOCATION — BESIDE OPERATOR
ON RIGHT HAND P.O.P.S. SIDE
PANEL.



GROUND PLUG
PART NO. — 25312
LOCATION — RIGHT HAND CONTROL
PANEL



ENTERING AND EXITING
PART NO. 28096
LOCATION — BELOW SEAT ON
HYDROSTATIC SHIELD

8 MAINTENANCE / SPECIFICATIONS

8.5 DECALS:

EMERGENCY START
PART NO 23471
LOCATION — TOP LEFT HAND
CORNER ABOVE SAFETY BAR,
NEXT TO EMERGENCY START BUTTON.

EMERGENCY START

DEPRESS AND HOLD BUTTON. TURN
IGNITION SWITCH TO START



CONTROL LEVER
PART NO 15916
LOCATION — LEFT AND RIGHT
HAND SIDE PANEL OF R.O.P.,
BELOW SCREEN, FACING
CONTROL LEVELS

BOOM LOCK
PART NO 25062
LOCATION — LEFT
HAND CONTROL PANEL

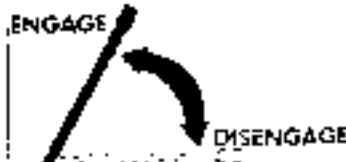
ATTENTION

BOOM LOCK CONTROL



DO NOT MOVE LIFT ARMS WITH LOCKS ENGAGED.

PARKING BRAKE



PARKING BRAKE
PART NO 17245
LOCATION — LEFT HAND MAIN FRAME,
BELOW SCREEN, FACING
PARKING BRAKE.

FAST
SCHNEEL
RAPIDO
VITE



THRUSTLE CONTROL
LEVER
PART NO 2496
LOCATION — LEFT HAND
WALL OF R.O.P.'S
BELOW SCREEN FACING
LEFT CONTROL LEVELS

SLING
LANGSAM
LENTO
LONTA

STOP
HÄLT
GETT NEK
ÄRRE!

WARNING

KEEP HANDS
AND CLOTHING
AWAY FROM
ROTATING FAN
AND BELTS TO
PREVENT
SERIOUS INJURY

FAN WARNING
PART NO — 26387
LOCATION — TOP OF FAN SHROUD

8.5 DECALS:


! WARNING

TO PREVENT INJURY, SHIELD MUST BE IN PLACE BEFORE OPERATING

— 3234

SHIELD WARNING
PART NO. — 32305
LOCATION — FRONT STEP SHIELD

! WARNING



TO PREVENT AN OVER TRAVEL WITH LOAD LIFT, DO NOT ALLOW BUCKET LOAD TO EXCEED THE LOADS RATED LIFTING CAPACITY. FASTEN THE SAFETY BELT.

SERIES	MAX. CAPACITY
333	600 lbs 267 KG
335	1000 lbs 454 KG
338	1700 lbs 771 KG
339	1500 lbs 680 KG
340	1900 lbs 865 KG
341	2300 lbs 1043 KG

TM2241

TRAVEL WITH LOAD LOW
PART NO. — 324E1
LOCATION — L.H. SIDE HYDROSTATIC SHIELD


! CAUTION

STEERING LEVERS ARE LOCKED WHEN SPAT ROPS IS UP. PARKING LEVERS WITH PARKING BRAKE ENGAGED WILL CAUSE ROPS TO DROP WHEN AT MAXIMUM CONTACT. HOLD THE MAX. DECELERATION SAFETY SYSTEM ADJUSTMENTS.

TM2241

STEERING LEVERS
PART NO. — 324B3
LOCATION — R.H. ROPS SIDE PANEL

! WARNING



TO PREVENT INJURY, ENSURE THE ATTACHMENT IS SECURELY FASTENED TO THE QUICK-TACH BY CHECKING THAT BOTH THE QUICK TACH HANDLE LOCK AND LOCK PINS ARE FULLY ENGAGED BEFORE OPERATING THE LOADER.

QUICK-TACH LOCK WARNING
PART NO. — 3227A
LOCATION — FRONT OF BOOM ARM

ATTENTION

DO NOT OPERATE MACHINE WITH PARKING BRAKE ENGAGED or will cause damage to Brake System !!!

TM 2543

PARKING BRAKE
PART NO. — 25812
LOCATION — L.H. ROPS SIDE PANEL

THIS MACHINE AND ITS COMPONENTS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS:

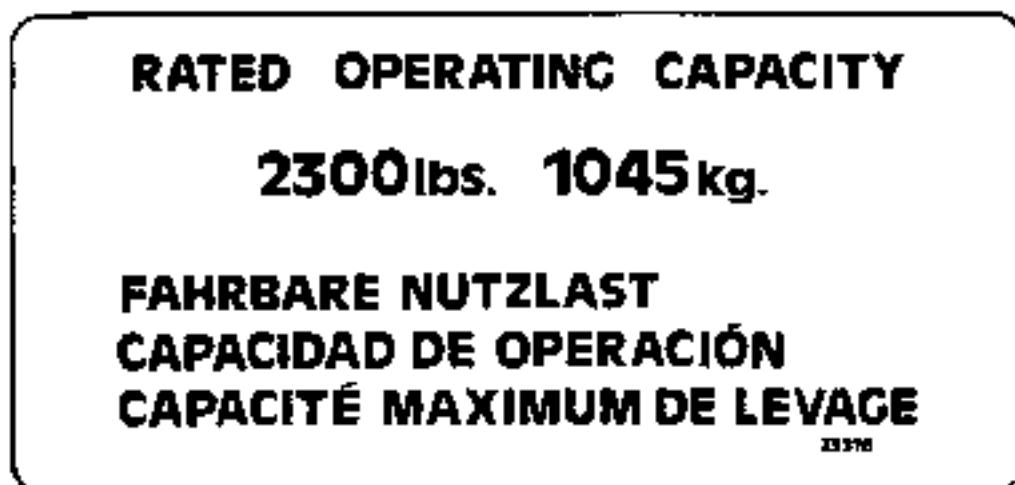
CANADIAN	U.S.
1 073 263 PENDING	3 770 267 PENDING
454 321	3 610 517 134 352
	4 288 596
	4 591 344
	4 387 311 TM 2543

PATENT PROTECTION
PART NO. — 25169
LOCATION — (ON INS OF FUEL TANK)

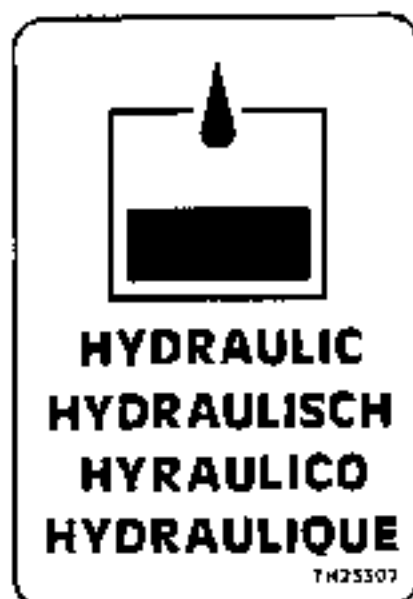
8.5 DECALS



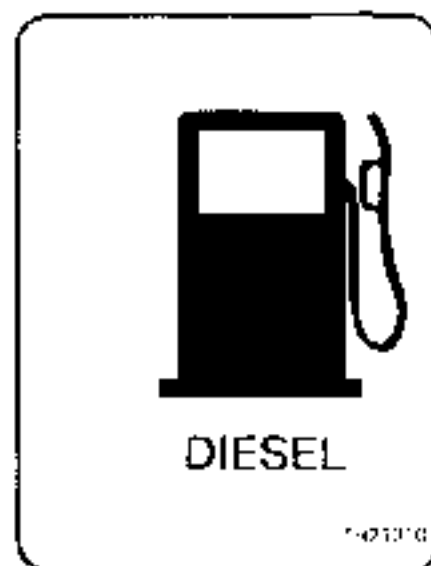
T103HD CAPACITY
PART NO. — 20513
LOCATION — HYDROSTATIC SHIELD



T233HD CAPACITY
PART NO. — 23318
LOCATION — HYDROSTATIC SHIELD



HYDRAULIC OIL
PART NO. — 25307
LOCATION — OUTSIDE OF HYDRAULIC TANK NEXT TO FILL POINT



DIESEL FUEL
PART NO. — 23210
LOCATION — OUTSIDE OF FUEL TANK NEXT TO FILL POINT