

PRICE: \$10.00

OPERATOR'S MANUAL

MAGNATRAC HYDRO-5000

SERIAL NUMBER: _____

MODEL NUMBER: _____

TO THE OPERATOR

RECOGNIZE SAFETY INFORMATION



This is the safety-alert symbol. When you see this symbol on your Crawler or in this manual, be alert to the potential for personal injury.

UNDERSTAND SIGNAL WORDS

A signal word--DANGER, WARNING, or CAUTION--is used with the safety-alert symbol. DANGER identifies the most serious hazards.

Safety signs with the signal word DANGER or WARNING are typically near specific hazards.

General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

FOLLOW SAFETY INSTRUCTIONS

Carefully read all safety messages in this manual and on your Crawler and Attachment safety signs. Follow recommended precautions and safe operating practices.

Keep safety signs in good condition. Replace missing or damaged safety signs.

To keep your Crawler running efficiently, read the instructions in this Operator's Manual.

Left side, right side, front, and rear are viewed by facing in the direction of the Crawler's forward travel.

Record your Crawler serial numbers in the space provided. You need this information when you order parts.

The Warranty of this Crawler appears on the last page of this manual.

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W51-N545 STRUCK LANE
CEDARBURG, WISCONSIN 53012
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SAFETY RULES



Reports on accidents show that careless use of machinery causes a high percentage of accidents. You can avoid many accidents by following the safety rules on these pages. Study these rules carefully and enforce them on the job.

SAFETY BEFORE STARTING OR OPERATING

The Crawler should be operated only by persons approved to do so.

Clothing worn by the operator should be fairly tight and belted.

Fasten a first aid kit to the Crawler.

Fasten a fire extinguisher to the Crawler. Keep the extinguisher fully charged. Learn to use it correctly.

If the Crawler has an unsafe condition, do not operate. Put a tag on the Track Drive Controls.

Do not start or operate the Crawler unless you are in the operator's seat.

Before you start the Engine, be sure there is plenty of ventilation.

Keep hands, feet, and clothing away from power-driven parts.

Fasten a slow-moving vehicle sign to the rear of the Crawler.

Do not change Backhoe or Loader relief valve setting without consulting factory.

Before you operate Backhoe, be sure stabilizers are in correct position.

Guards, shields, and other protective devices must be in place and in good condition.



Before you start or operate the Crawler, clear the area of all persons and obstacles.

OPERATION SAFETY

When you operate the Crawler, do not allow anyone to ride on the Crawler or its equipment.

Drive at safe speeds at all times, especially on rough ground and hillsides.

Carry the Bucket or Blade as low as possible at all times, especially when you work on a hillside or back up a steep hill.

Do not lower a loaded Bucket or Fork with the control lever in float position.

Do not drive too close to the edge of a ditch or excavation.

Watch for overhead wires. Do not touch wires with any part of the Crawler or its Attachments.

Do not leave your Crawler unattended with the Engine running.

Keep work areas as level as possible.

Do not operate the Crawler Loader without the minimum recommended counterweights.

Do not dig under stabilizers of Crawler with the Backhoe.

When loading logs with the Log Forks, make sure the logs are balanced.

Before you transport the Backhoe, attach the safety chains provided.

When you drive out of a ditch or excavation, or up a steep hillside, or when Crawler is hitched to a heavy load, **engage Track Drive Controls slowly**. If the front of the Crawler comes off the ground, release Track Controls **immediately**.

When you operate the Backhoe on a hillside, avoid swinging Bucket downhill. If possible, dump Bucket on the uphill side.

Before you lower any hydraulic equipment, be sure all persons are away from the Crawler.

Do not use the Crawler as a battering ram.

Do not guide cable onto Winch Drum with your hands.

When you drive the Crawler on a road, use the correct lights to warn operators of other vehicles.

Before you move any equipment, be sure all persons are away from the Crawler.

When the Crawler is operating, **only** the operator should be on it.

If it is necessary to make checks with the Engine running, **always use two people**...the operator at the controls, should be able to see the person doing the checking.

KEEP HANDS AWAY FROM MOVING PARTS.



DANGER: Never use "quick-disconnect" type couplings anywhere on this Crawler or any of its mating Attachments...to do so results in the potential of rupturing hydraulic fittings or even "blowing-up" your Hydraulic Pumps!

BEFORE YOU DISMOUNT:

- 1) **Move Track Drive Controls to neutral.**
- 2) **Push down Parking Brake and Lock.**
- 3) **Lower all equipment to the ground.**
- 4) **Stop Engine and remove the key.**

SERVICE SAFETY

Be sure you understand a service procedure before you work on the Crawler.

Unauthorized modifications to the Crawler may impair the function and/or safety and affect Crawler life.

Do not work under raised equipment unless it is correctly supported.



Before you work on the Engine or electrical system, disconnect the battery's "ground" (-) terminal first! When work is finished, connect battery's "ground" terminal (-) last.

When driving connecting pins, wear goggles or safety glasses.

Do not run Engine while working on the Crawler.

Be careful when handling any type of fuel. Do not smoke while filling the fuel tank or working on the fuel system.

Check for faulty wiring or loose connections.

Do not lubricate or work on the Crawler while it is moving.

Release hydraulic pressure before working on hydraulic system. Move **every** hydraulic control lever back & forth until equipment does not move.

Before using the hydraulic system, be sure that all connections are tight and that lines are in good condition.

When you work near the Track Springs, use **extreme care**. Do not disassemble parts unless you know the correct procedure and have correct tools.

FIRE PREVENTION MAINTENANCE

Be prepared if an accident or fire should occur. Know where the first aid kit and the fire extinguishers are located--know how to use them. Check fire extinguisher for correct charge.

Do not smoke while refueling or handling highly flammable material.

Shut off the Engine when refueling.

Use care in refueling if the Engine is hot.

Do not use open pans of gasoline or diesel fuel for cleaning parts. Use good commercial, nonflammable solvents.

Provide adequate ventilation when charging battery.

Do not check battery charge by placing metal objects across the posts.

Do not allow sparks or an open flame near battery. Do not smoke near battery.

Never check fuel, battery electrolyte, or coolant levels with an open flame.

Never use an open flame to look for leaks anywhere on the equipment.

Never use an open flame as light anywhere on or around the equipment.

When preparing Engine for storage, remember that inhibitor is volatile and therefore dangerous. Seal and tape openings after adding the inhibitor. Keep container tightly closed when not in use.

Inspect electrical wiring for worn or frayed insulation. Install new wiring if wires are damaged.

Temperature in Engine and cooling compartments may go up immediately after you stop the Engine. **Be on guard for fires.**

Before you clean trash from the Engine compartment, wait until the Engine has cooled. Open Side Panels to cool the Engine faster. While the Engine cools, clean trash from other areas.

Check for leaking fuel lines, hydraulic lines, hoses, or fittings with a piece of cardboard or wood. Do not use your hands. Tighten loose fittings. If lines are bent or hoses kinked, install new parts.

PROTECT AGAINST NOISE

Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noise.

AVOID HIGH-PRESSURE FLUIDS

Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury or gangrene may result.

INSTALL AND MAINTAIN ROPS PROPERLY

If Roll-Over Protective Equipment is loosened or removed for any reason, make certain all parts are reinstalled correctly. Tighten mounting bolts to proper torque. The protection offered by ROPS will be impaired if the ROPS is subject to structural damage, has been involved in an overturn incident or is in anyway altered. Damaged ROPS should be replaced, not reused.

DO use your Seat Belt if your Crawler has a Roll-Over Protective Structure (ROPS).

DO NOT use a Seat Belt if your Crawler does not have a ROPS.

ROLL-OVER PROTECTIVE STRUCTURE (ROPS)

To prevent serious injury in the event of tractor tipover:

- Wear Seat Belt.
- Do not jump if tractor tips.
- Avoid crushing of operator.
- Keep this Roll-over Protective Structure in place.
- Replace damaged Protective Structure...don't repair!

Any alterations to this Protective Structure must be approved by the factory!

START ENGINE ONLY FROM THE OPERATOR'S SEAT!


Avoid possible injury or death from Crawler runaway.

Do not start Engine by shorting across starter solenoid terminals. Crawler may start and move if normal circuitry is bypassed.

Never start Engine while standing on ground. Start Engine only from operator's seat, with Parking Brake engaged.

Inspect your Crawler carefully each day before you start it. See "Pre-Start Inspection".

Clean your Crawler regularly.

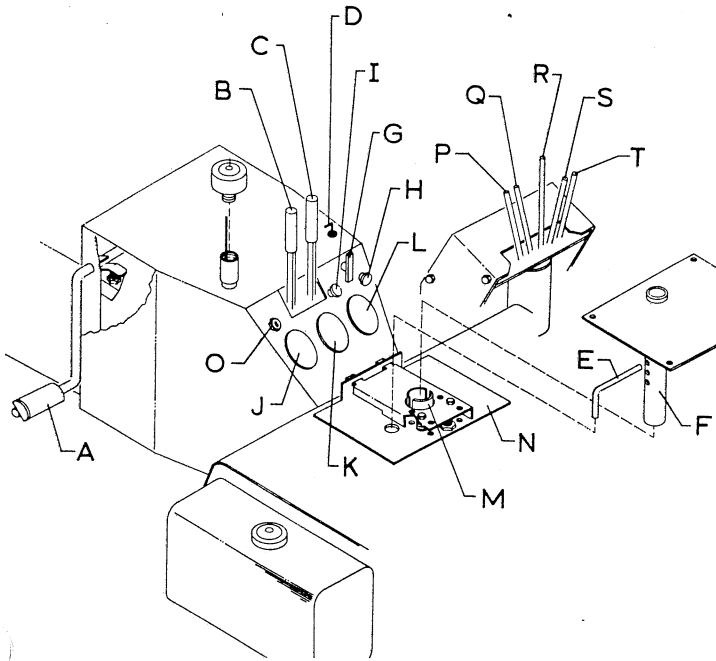
WARNING

Seat Pin should engage "slotted tube" and its handle should engage hole...see Operator's Manual for complete explanation of proper seat positioning & adjustment.

This **Seat Pin** activates a **Seat Safety Switch** which prevents engine starting in an unsafe condition and also stops engine if operator leaves his seat. Do not electrically bypass or otherwise defeat this **Safety Switch**!

CONTROLS AND INSTRUMENTS

Learn the location and purpose of all controls, instruments, and warning labels.



CONTROLS

- (A) PARKING/EMERGENCY BRAKE
- (B) LEFT TRACK CONTROL
- (C) RIGHT TRACK CONTROL
- (D) BRAKE LOCK HANDLE
- (E) SEAT PIN
- (F) SEAT POST
- (G) THROTTLE CONTROL
- (H) CHOKE CONTROL
- (I) LIGHT SWITCH
- (M) SEAT TUBE
- (N) MOUNT
- (O) IGNITION SWITCH
- (P) BUCKET CONTROL
- (Q) LIFT CONTROL
- (R) OVERDRIVE CONTROL
- (S) HITCH CONTROL
- (T) ACCESSORY CONTROL

INSTRUMENTS

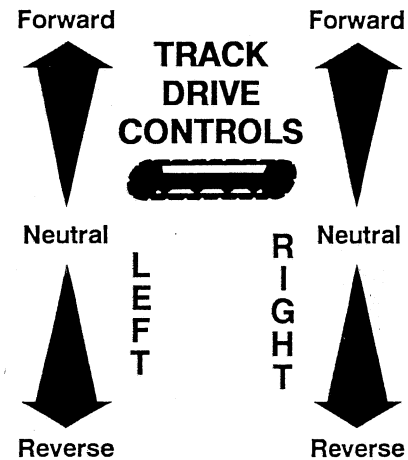
- (J) HOUR METER
- (K) HYDRAULIC OIL TEMPERATURE GAUGE
- (L) AMMETER

(A) PARKING/EMERGENCY BRAKE



Apply Brake by pushing forward on its pedal with left foot. Brake will lock if pedal is pushed completely forward.

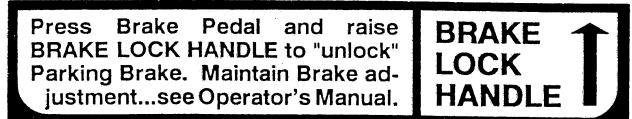
(B) LEFT and (C) RIGHT TRACK CONTROLS



- 1) To move straight ahead, push both Left and Right Track Controls forward.
- 2) To move straight rearward, pull both Left and Right Track Controls rearward.
- 3) To turn right, push forward on Left Track Control.
- 4) To turn left, push forward on Right Track Control.
- 5) To counter-rotate Tracks (shortest turn possible), push one Track Control forward while simultaneously pulling rearward on the other Track Control.

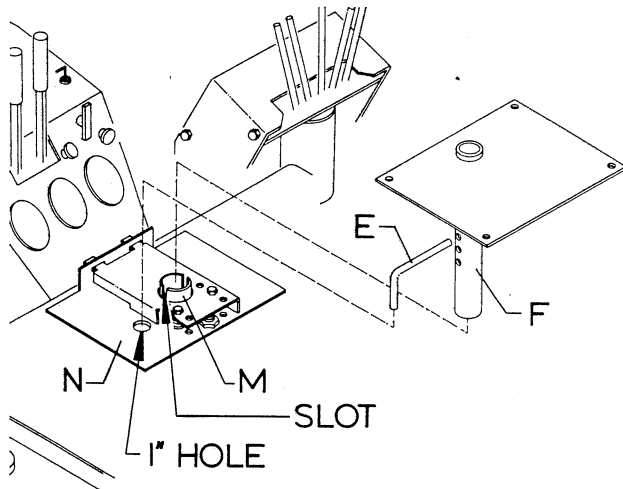
NOTE: When either Track Control lever is released, it will automatically return to neutral.

(D) BRAKE LOCK HANDLE



To release Brake, apply foot pressure to Brake Pedal (A) and raise Brake Lock Handle (D); slowly release foot pressure and allow Brake Pedal to come rearward to its natural unbraked position.

(E) SEAT PIN, (F) SEAT POST, (M) SEAT TUBE and (N) MOUNT

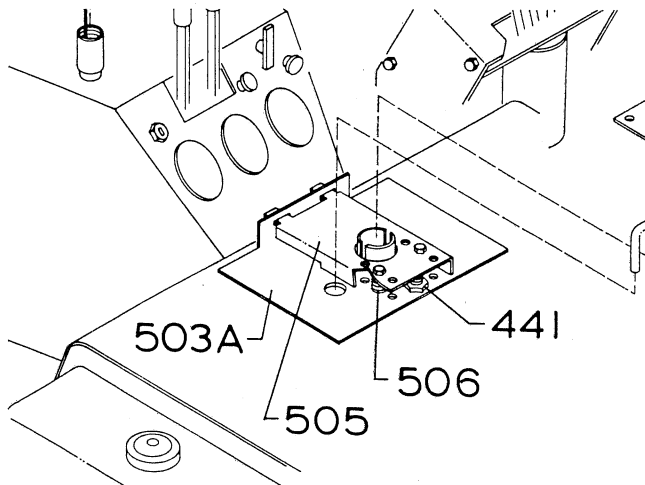


1) Adjust seat height by inserting the Seat Pin (E) into the appropriate hole of Seat Post (F). Lower Seat Post into Seat Tube (M) and engage Seat Pin in slots of Seat Tube.

NOTE: As you lower the Seat Post into the Seat Tube, make sure the **handle** of the Seat Pin passes into the 1" diameter hole in the Mount (N).

2) To set seat height for backhoeing, remove Seat Pin, rotate seat 180 degrees, reinsert Seat Pin into lowest hole in Seat Post, lower Seat Post into Seat Tube and pass **handle** of Seat Pin into the 1" diameter hole in the Mount.

3) To slide seat forward or back to the most comfortable position, push lever (under the right lower corner of the seat) to the left to release Seat Lock. Release lever to **lock** seat into new position.



4) In order to keep young children from operating the Crawler, it is possible to adjust the seat weight necessary to activate the #441 Seat Safety Switch. See the SERVICE section of this manual for a complete explanation of varying the seat weight adjustment by moving the #506 Springs.

(G) THROTTLE CONTROL

THROTTLE

PULL OUT



SLOW



FAST



1/4 TURN TO LOCK

Pull control handle toward operator to increase Engine speed...turn handle 1/4 turn clockwise to **lock** throttle setting (Do not over-tighten!)

(H) CHOKE CONTROL

CHOKE

PULL OUT



Pull control handle toward operator to increase amount of Engine choking. Push fully back to stop choking.

(I) LIGHT SWITCH

LIGHTS

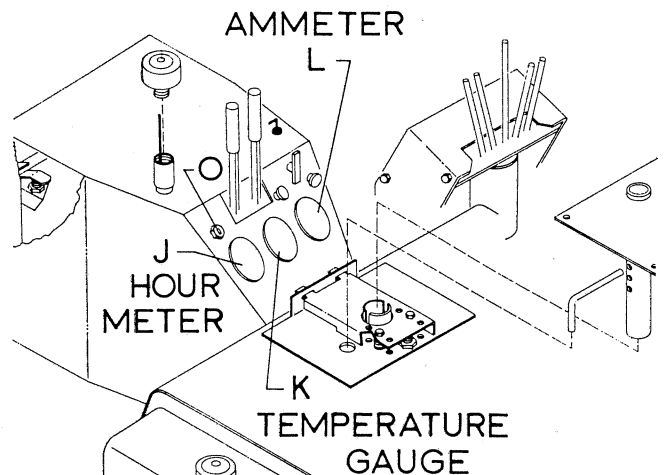
PULL OUT



Pull control handle toward operator to turn lights on. Push fully back to turn lights off.

(J) HOUR METER

Meter will begin recording time the moment the Ignition Switch (O) is switched to Run.



NOTE: The Engine does not have to be running for the Meter to record time...the Ignition Switch just has to be in the **Run** position. Always turn Ignition Switch **Off** and remove key when leaving Crawler. This will assure you that your Meter is recording only actual running hours!

(K) TEMPERATURE GAUGE

This gauge records the hydraulic oil temperature just as it enters the Traction Drive Pump. Monitor this temperature so that it **does not exceed 180 degrees Fahrenheit.**

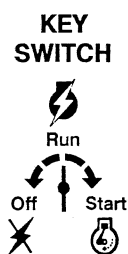
WARNING - Do not allow oil temperature to exceed 180 degrees...damage may result!

If the oil temperature exceeds 180 degrees, stop operating the Crawler, but allow the Engine to operate at medium speed to circulate the oil through the radiator and lower its temperature.

(L) AMMETER

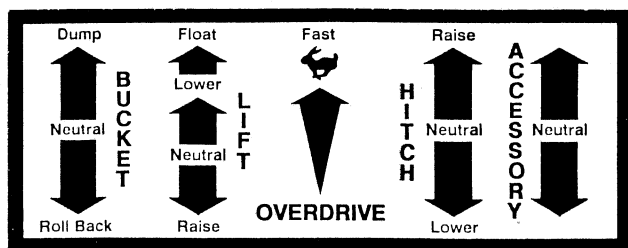
Measures electrical charge or discharge to battery. If Ammeter shows a discharge, shut down electrical system by turning Ignition Switch to **Off** and determine the problem.

(O) IGNITION SWITCH



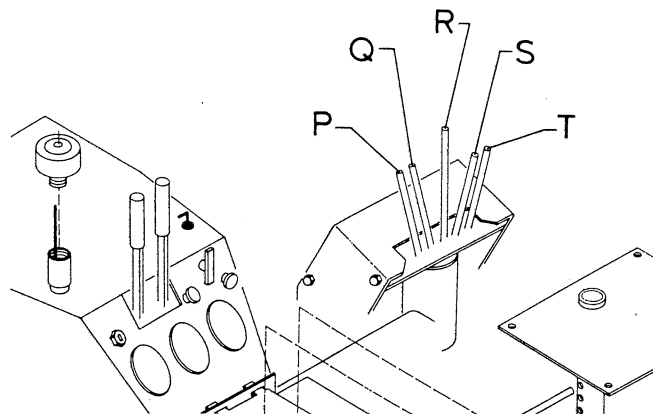
Switch is activated by rotating key clockwise. Turning it fully clockwise will engage Engine starter...release key and it will return automatically to the **Run** position. Turn fully counter-clockwise to **Off** position to stop Engine. Remove key.

AUXILIARY HYDRAULIC CONTROL BANK

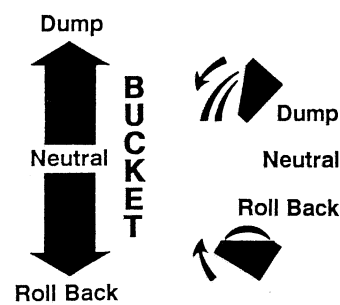


NOTE: All controls in this Control Bank are spring loaded to automatically return to a neutral

position when each control handle is released, except for the Accessory Control (**T**) which has positive locks for its three operating positions, and the Lift Control (**Q**) which **locks** in the float position only.

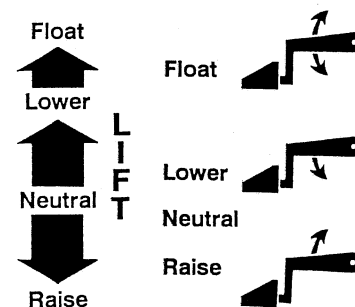


(P) BUCKET CONTROL



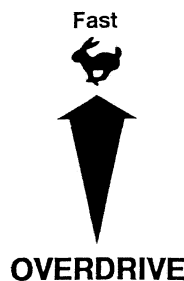
Push the control handle forward to dump bucket. Pull rearward to roll bucket back.

(Q) LIFT CONTROL



Pull the control handle rearward to raise Loader Arms. Push the control handle forward to lower the Loader Arms. (Push handle fully forward to **lock** into float position).

(R) OVERDRIVE CONTROL (OD16 Option)

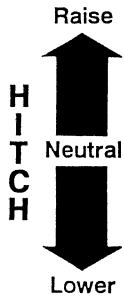


With both Track Drive Controls activated, push Overdrive Control handle forward to gain extra speed...release handle to resume normal speed.

NOTE: The Overdrive Control is designed for bursts of speed to get out of excavations, go quickly to dump locations, etc. It is **not intended** for constant use!

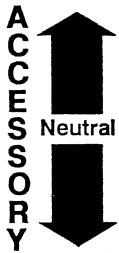
The Overdrive functions by by-passing the oil cooling radiator and directing its flow of oil to the Track Drive Motors. If your Hydraulic Oil Temperature Gauge (K) starts indicating temperatures in excess of 180 degrees, discontinue the Overdrive's use until the oil temperature drops to more normal levels.

(S) HITCH CONTROL (VC12 Option)



Push the control handle forward and the rear-mounted implement will rise. Pull handle rearward and the implement will lower.

(T) ACCESSORY CONTROL (VC24M Option)



This control is for attachments designed by the Crawler's owner/operator. It will also be used for hydraulic motor applications in the future. **NOTE:** This control will lock in each of its three possible positions...do not rely on it to automatically return to neutral as do other valve sections on this bank.

OPERATION

PRE-STARTING INSPECTION

Before you start your Crawler for the first time each day, perform the following checks:

ENGINE COMPARTMENT

- Check oil level.
- Check air intake system.
- Check fuel filter.
- Remove trash and oil-dirt deposits.

GRILL AND SIDE PANELS

- Remove trash.
- Clean radiator.

TRACKS, ATTACHMENTS, SHEET METAL

- Check for bent, broken, or missing parts.
- Check Track Springs.

HARDWARE

- Check for loose or missing parts.

ELECTRICAL SYSTEM

- Check for worn or frayed wires or loose connections.

LUBRICATION

- Check lubrication points shown in Periodic Service section of this manual.

GUARDS AND SHIELDS

- Check for tightness and condition.

BATTERY COMPARTMENT

- Remove trash.
- Check cables for tightness and corrosion.

FUEL TANK

- Check fuel level.

HYDRAULIC SYSTEM

- Check for leaking lines and connections.
- Check for bent or kinked lines.
- Check for lines rubbing against each other or against other parts.
- Check oil level.

OPERATOR'S STATION

- Check levers for free movement.
- Check ROPS and Seat Belt.
- Clean floor and instrument panel.
- Adjust Seat to comfortable height for operator.



CAUTION - Before you start the engine:

- 1) Check the condition of the Crawler. (Pre-start inspection).
- 2) Be sure there is enough ventilation.
- 3) Be sure to know the correct starting and stopping procedure.
- 4) Sit in the operator's seat.
- 5) Clear the work area of people and obstacles.

IMPORTANT: Do not tow or push your Crawler to start it. You may damage the hydraulic drive system.

PREPARE FOR ENGINE STARTING

- 1) Fasten Seat Belt (only if you have ROPS installed).
- 2) Allow Left (B) and Right (C) Track Controls to assume their natural **spring loaded** center **neutral** positions.
- 3) Push forward on Parking/Emergency Brake (A) until Brake Lock (D) drops and holds the braked position.
- 4) Check that Loader or front-mounted Bulldozer Blade is in the fully lowered position, and that the Backhoe is in the **chained** safe traveling position.
- 5) Check that all other hydraulic controls are in their **centered** neutral position.

NOTE: The hydraulic Accessory Control (T) does not have a **spring loaded** neutral centering device; therefore, you must move it back and forth to determine its **center-neutral** position.

- 6) Make sure you are properly seated so Seat Safety Switch will engage - lean **forward** if you have seat set **rearward**.

STARTING THE ENGINE


1a) **On a Cold Engine** - Place the Throttle Control (G) midway between the **Slow** and **Fast** positions. Place the Choke Control (H) into the **On** position.


1b) **On a Warm Engine** (normal operating temperatures) - Place the Throttle Control midway between the **Slow** and **Fast** positions. Place the Choke Control into the **Off** position.

2) Activate the Ignition Switch (O) by rotating it clockwise until starter engages. Release the switch as soon as the Engine starts...Switch will return to the **Run** position.

3) On a Cold Engine - Gradually return the Choke Control (H) to the **Off** position after the Engine starts and warms up.

NOTE: After starting the Engine, it may be necessary to leave the Choke partially **On** for a few minutes before moving it to the **Off** position.


 **CAUTION:** Do not crank the Engine continuously for more than 10 seconds at a time. If the Engine does not start, allow a 60-second cool-down period between starting attempts. Failure to follow these guidelines can burn out the starter motor.

 **CAUTION:** If the Engine develops sufficient speed to disengage the starter but does not keep running (a "false start"), the Engine rotation must be allowed to come to a complete stop before attempting to restart the Engine.

If the starter is engaged while the flywheel is rotating, the starter pinion and flywheel ring gear may clash, resulting in damage to the starter.

If the starter does not turn the Engine over, shut off starter immediately. Do not make further attempts to start the Engine until the condition is corrected.

If the battery charge is not sufficient to turn over the engine, recharge the battery.

 **CAUTION:** Do not attempt to jump start the engine with another battery. Starting with batteries larger than those recommended can burn out the starter motor.

WARM-UP PERIOD

1. Run Engine at half speed for 5 minutes.
2. Do not run Engine at fast, or slow idle.
3. Operate Crawler at less-than-normal loads and speeds for the first 15 minutes.



WARNING: Lethal Exhaust Gases

Engine exhaust gases contain poisonous carbon monoxide. Avoid inhaling fumes, and never run the Engine in a closed building or confined area.

NOTE: Assembled Crawlers are "run in" under no load at the factory for 15 minutes to properly break-in their drive train and track drive motors.

USE SEAT BELT

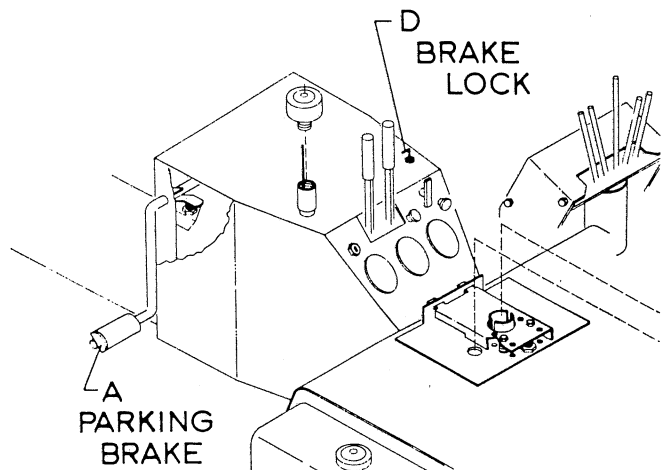


CAUTION: Use a Seat Belt when you operate with a Roll-Over Protective Structure (ROPS) to minimize chance of injury from an accident such as an overturn.

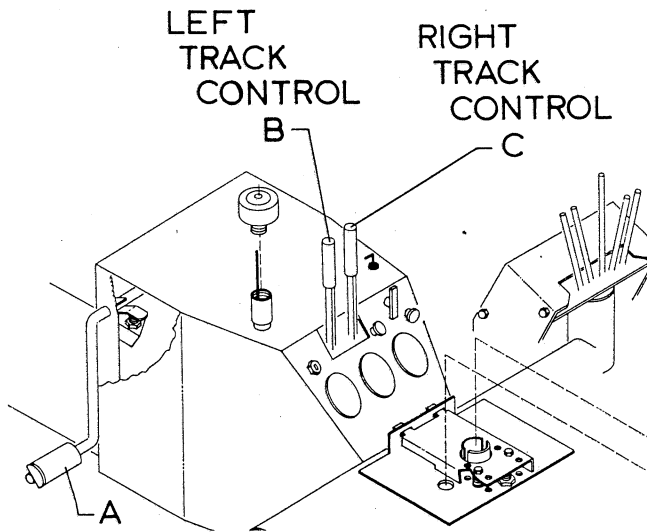
Do not use a Seat Belt if operating without a ROPS.

TRAVELING

Push forward on Parking Brake (A) and raise Brake Lock (D); slowly release pressure on Parking Brake and allow it to come back to its natural "rearward" position...remove foot from Brake!



Raise all attachments to their recommended traveling heights.



A) To move straight ahead, simultaneously push Right Track Control (C) and Left Track Control (B) forward.

B) To move straight to the rear, simultaneously pull both Right and Left Track Controls rearward.

C) To turn to the right, push Left Track Control forward.

D) To turn to the left, push Right Track Control forward.

E) To counter-rotate Tracks, (shortest turn possible), push one Track Control forward while simultaneously pulling rearward on the other Track Control.

NOTE: The Right and Left Track Controls are of the self-centering (neutral) "deadman" type. This allows you to simply let go of both Track Controls to disconnect active power to the Tracks.

F) Parking/Emergency Brake (A) will stop or hold Crawler in the neutral drive position.

PARKING THE CRAWLER

- 1) Lower all equipment to the ground.
- 2) Allow Right and Left Track Controls to go to neutral.
- 3) Push forward on Parking Brake and lock.

4) Run Engine at half speed 2 minutes without load.

5) Move Throttle Control to slow idle.

6) Turn Ignition Switch to **Off**.

7) Release hydraulic pressure by "rocking" all hydraulic controls back and forth.

IMPORTANT: If Engine stops under load, remove load. Start Engine immediately. Run 30 seconds at half speed before adding load.

NOTE: If engine stops, you must turn key **Off** before you can start the engine.

IMPORTANT: In freezing weather, park on a hard surface to avoid freezing the Tracks to the ground. If Tracks are frozen to the ground, be careful to avoid damage to the Tracks and drive train when you try to move the Crawler.



CAUTION: When you park your Crawler on a slope, put blocks against tracks. **Do not** park Crawler with tracks pointed downhill.

FUELS and LUBRICANTS

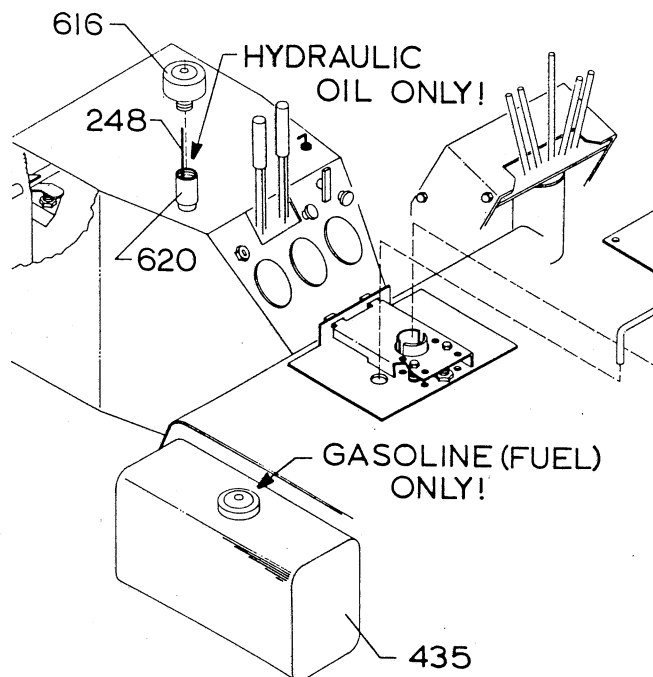
FUELS

FUEL SPECIFICATIONS

Check enclosed Engine Owner's Manual and closely follow their recommendations.

FILLING FUEL TANK (GASOLINE ONLY!)

The #435 Fuel Tank is located to the left of the operator's seat.



CAUTION: Do not confuse the #435 Fuel Tank (GASOLINE) with the Hydraulic Oil Tank which is filled through a "pipe" on top of the Crawler's dash...remove #616 Breather for filling!

Fill Fuel tank at end of each day's operation.

Fuel tank capacity is 3 U.S. gallons.

CAUTION: Handle fuel carefully. Do not fill fuel tank when the Engine is running. Do not smoke while you fill fuel tank or work on fuel system.

STORING FUELS

Keep fuel in a container in a protected area. Water and sediment must be removed before fuel gets to the Engine. Do not depend on fuel filters to remove water.

If possible, install a water separator at the storage tank outlet.

Store fuel drums on their sides with plugs up.

IMPORTANT: Keep all dirt, scale, water, or other foreign matter out of fuel.

LUBRICANTS

ENGINE OIL

Check enclosed Engine Owner's Manual and closely follow their recommendations.

HYDRAULIC OIL

Premium quality hydraulic oil with operating viscosity range of 80-1000 SSU. Maximum start-up viscosity is 4000 SSU. Oil should have maximum anti-wear properties, rust and oxidation treatment (Mobil - DTE Series 10, ISO of 32).



TRACK SPROCKETS AND IDLERS OIL

Use a non-additive, non-detergent variety of oil...SAE 30 in summer; SAE 10 in winter.

GREASE

Use premium quality SAE Multi-Purpose Grease.

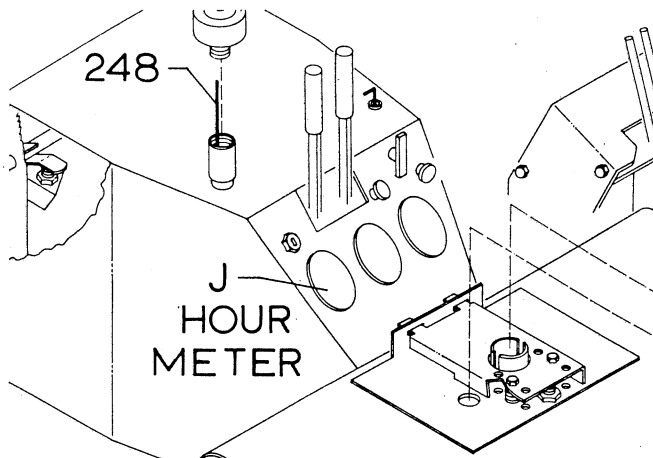
STORING LUBRICANTS

Store lubricants in clean containers in an area protected from dust, moisture, and other contamination.

LUBRICATION and PERIODIC SERVICE

HOUR METER

Use the Hour Meter (J) to determine when periodic services are required.



LUBRICATION AND SERVICE INTERVALS

IMPORTANT: Recommended service intervals are for normal conditions. Service **more often** if Crawler is operated under difficult conditions.

IMPORTANT: Use only quality lubricants at intervals specified in this manual.

PERIODIC SERVICE CHART

DAILY OR EVERY TEN HOURS

Air Cleaner - Service per instructions in Engine Owner's Manual.

Engine Oil - Service per instructions in Engine Owner's Manual. **NOTE:** First oil change for a new Engine is at 5 hours.

Hydraulic Oil - Check level; with equipment on the ground (all cylinders should be retracted), level should be between marks on #248 Dipstick (Dipstick can be found when you unscrew and remove #616 Breather).

Grease Zerks - Lubricate all zerks per location instructions in manual of each attachment you have mounted on your Crawler.

Radiator - Remove #488 Left and #489 Right Side Panels. With low pressure air, blow clean the "fins" of #470 Radiator (oil cooler).

Track Tension - Maintain 4-1/2" overall length of #233 Yellow and #234 Black Springs on each Track. In addition, check that 7/16" Washer against front face of each #215 Front Axle is **not** loose enough to be rotated with fingers. Check Service section of this manual for complete explanation and Track tensioning procedures.

Drive Chain Tension - Maintain chain tension in drive train. Check Service section of this manual for complete Drive Chain Tensioning procedures.

Fittings & Hoses - Check hydraulic fittings and hydraulic hoses for cracks, breaks, and leaks.

Safety Module (#490) - Check for proper functioning...see Service Section.

General Once-Over - Check for loose nuts and bolts and any signs of premature wear. Correct any problems immediately. **NOTE:** Check "NOTE" in Service Section of this manual for information on Track Idler wear!

EVERY FIFTY HOURS

Engine Oil - Drain and refill per recommendations in Engine Owner's Manual.

NOTE: Change Engine oil every 25 hours if you're working under constant heavy loads or extremely dirty conditions.

Battery - Check electrolyte level and fill with distilled water to the bottom of the filler neck.

Filters -

A) Replace Engine Filter with filter recommended in Engine Owner's Manual.

B) Replace Hydraulic Oil Filter with a new #680B Filter Canister.

- C) Check #535 Fuel Filter for dirt; if showing sediment, replace with new.

Tracks, Track Sprockets, and Idlers - Remove and pressure wash Track. Pressure wash Track Sprockets and Idlers. Lubricate bearings in Track Sprockets and Idlers following the procedure in the Service section of this manual.

EVERY 200 HOURS

Hydraulic Fluid - Completely drain system by removing plug in left rear corner on underside of Crawler's Upper Frame. **NOTE:** Drain when fluid is warm; block up the right front corner of Crawler a few inches to get oil to flow completely to drain opening.

Fuel Filter - Replace with new #535 Fuel Filter at this time.

Fuel Tank - Remove and drain tank of any water or sediment.

SERVICE

ENGINE

Your Crawler comes with a complete Engine Service Manual. It provides troubleshooting tips along with complete rebuilding procedures. If further help is needed, contact your local Engine dealer...he's listed in the telephone "Yellow Pages" under "Engines, gasoline".

STARTER

IMPORTANT: Do not hold down starter button longer than 10 seconds at a time. If the Engine does not start within 10 seconds, wait 60 seconds before pushing starter button again. After a false start, **do not** push starter button until Engine has stopped turning.


If the starter will not operate or operates sluggishly, check for the following:

- 1) Run down battery.
- 2) Dirty, loose, or corroded cables and wires.
- 3) Engine oil viscosity too heavy.

BATTERY

Your Crawler has a 12 volt, negative-grounded system with one battery.

BATTERY PRECAUTIONS

 **CAUTION:** Sulfuric acid in batteries is a poison and could cause severe burns. Avoid contact with skin, eyes, and clothes. When you work around batteries, protect eyes and face from battery fluid and explosion.

Antidotes for Sulfuric Acid:

EXTERNAL

1. Flush skin well with water.
2. Flush eyes for 15 minutes.
3. Get medical attention immediately.

INTERNAL

1. Drink a large amount of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.



CAUTION: Keep flames and sparks away from batteries.

Do not use booster cables or adjust post connections unless you know the correct procedure.

When you charge a battery or use a battery in a closed space, be sure there is enough ventilation.

Keep batteries where children cannot reach them.

Keep vent caps tight and level.

COLD WEATHER BATTERY SERVICE

During cold weather, keep electrolyte in battery at correct level. Keep battery fully charged.

BATTERY STORAGE

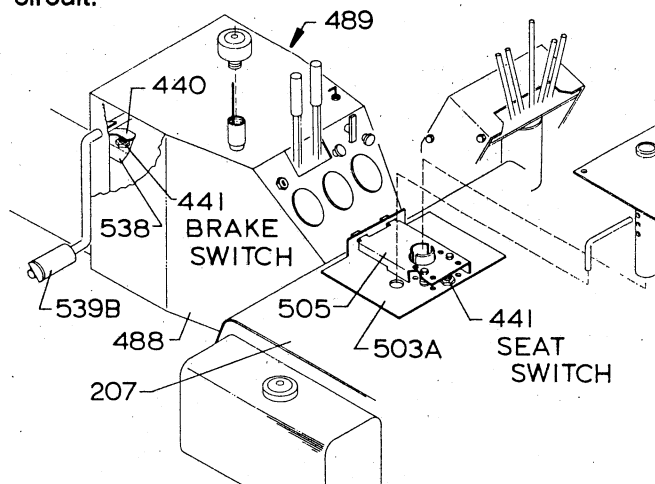
If Crawler will be stored for more than 30 days, remove battery. Keep it fully charged.

BATTERY MAINTENANCE

- 1) Remove corrosion from terminals with a stiff brush.
- 2) Clean battery with a baking soda solution (1/4 pound in a quart of water).
- 3) Flush battery and compartment with clear water.
- 4) Check electrolyte level. Fill each cell to bottom of filler neck with distilled water or clean, soft water (not hard water).
- 5) Put petroleum jelly on terminals. Maintain Protective Cover on "positive" (+) terminal of battery.

#441 INTERLOCK SWITCHES

Two #441 Switches are used in the Crawler's electrical system as safety devices to detect if the operator is properly seated and that the Parking Brake is engaged **before** the Crawler can start. The **plunger** in each #441 Switch has to be depressed for the Switch to **close** and activate the electrical circuits; the **plunger** has to be released for the switch to **open** and safely deactivate the circuit.



To check either the #441 Seat Switch or the #441 Brake Switch, you must remove the electrical plug attached to each switch's two terminals and connect a continuity tester to its terminals (a simple flashlight type would be fine).

#441 SEAT SWITCH TEST:

NOTE: To make this Test and subsequent adjustments, remove the 5/16" Cap Screws that hold the #207 Pan in place. Raise the Pan a few inches and reach underneath to remove the electrical plug attached to the #441 Seat Switch's terminals. With Plug removed, the Pan can be fully raised and removed for the following tests and adjustments.

A. With the #505 Treadle resting **flat** on #503A Mount, the #441 Seat Switch should be **closed**. A continuity tester, attached to the terminals of the Switch, should have its light **on** at this time!

B. With the #505 Treadle released and allowed to rise to the height permitted by the two **restraining** Cap Screws, the Switch should be **open**; the light should be **off**!

If **both** of the above conditions are not met, you must adjust the height of the #441 Seat

Switch. The Switch is secured top and bottom of the #503A Mount with large hex nuts. Raise or lower the Switch's height to meet requirements (**A**) and (**B**) in Seat Switch Test (above) by relocating these hex nuts.

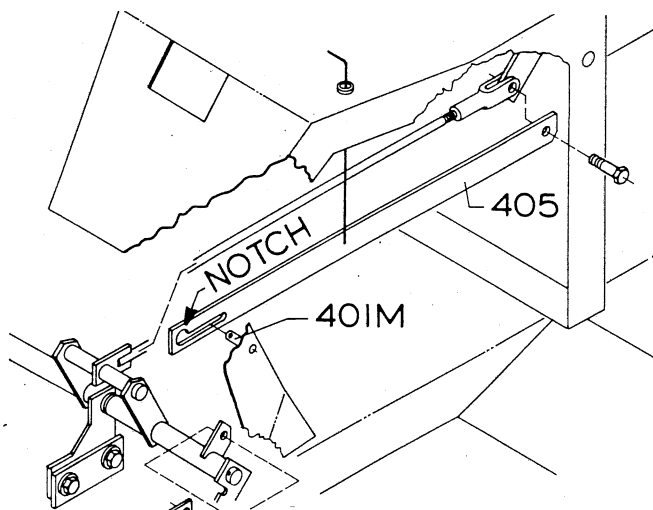
When adjustment is completed, tighten both hex nuts. Terminals of Switch should point directly to the left. Remove continuity tester and return #207 Pan back into position. Replace electrical plug on terminals of Switch and secure Pan with original Cap Screws.

At this time, following recommended safe starting procedures, start the Engine and check Switch's setting... readjust if necessary.

#441 BRAKE SWITCH TEST:

NOTE: For this Test remove the Cap Screws holding the #488 Left and #489 Right Side Panels. Remove the electrical plug from the #441 Brake Switch and connect a continuity tester to its two terminals.

A. When the #539B Brake Pedal is pushed forward until the **notch** in the end of the #405 Bar drops over its mating #401M Pin, the #441 Brake Switch should be **closed** (from contact with the rotated #440 Leaf Spring); the light of the continuity tester should be **on**!



B. With the Brake Pedal **unlocked** and allowed to travel rearward until it is stopped by the #401M Pin reaching the forward end at its mating slot in #405 Bar, the #441 Brake Switch should be **open** (the #440 Leaf Spring would have rotated up and away); the light of the continuity tester should now be **off**!

If **both** of the above conditions are not met, you must adjust the height of the #441 Switch.

The Switch is secured top and bottom of the #538 Bracket with large hex nuts. Raise or lower the Switch's height to meet requirements (A) and (B) in Brake Switch Test (above) by relocating these hex nuts. When adjustment is completed, tighten both hex nuts...terminals of Switch should point directly to the right. Remove continuity tester and replace electrical plug on terminals of Switch. Replace Left and Right Side Panels.

At this time, following recommended safe starting procedures, start the Engine and check Switch's setting...readjust if necessary.

#490 SAFETY MODULE

The #490 Safety Module is an electronic device inserted into the Crawler's electrical system to electronically sense **safe starting** and **safe operating** conditions. The Module performs its **safe start** function by sensing the condition of the Seat Switch and the Brake Switch. Both Switches must be **closed** before the Engine will crank over.

The **safe stop** function is accomplished by sensing the condition of the Seat Switch. Once the Engine is started, the operator must remain seated thereby keeping the Seat Switch **closed** or the Engine will shut down.

During Crawler operation, the Module will not cause the Engine to stop if the operator momentarily bounces in the Seat...the Module will always allow him approximately 3 seconds to reseat himself.

An added safety feature is its **closed to operate** function which ensures that the Crawler will not function if the switch leads are broken or become disconnected.

TESTING SAFETY MODULE

Conduct the following tests to check proper functioning of Safety Module:

A. Following recommended safe starting procedures, and with operator seated but Parking Brake not applied, attempt to start Engine. The Engine should not start. If it does, readjust #441

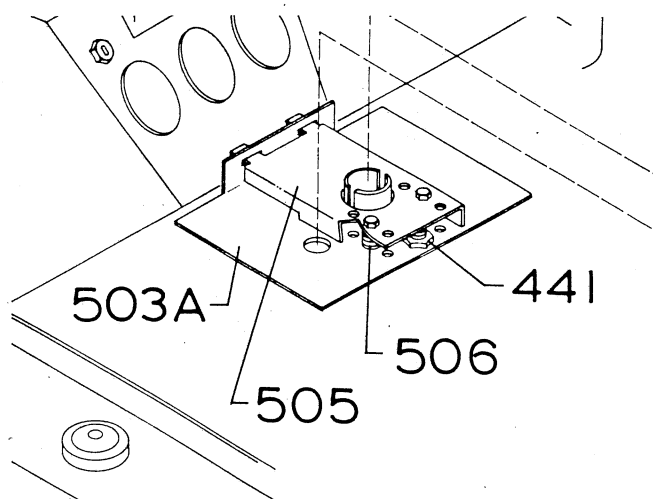
Switch on #538 Bracket; Switch is mounted too **high** in its Bracket and is **closing** too soon. If readjustment doesn't solve the problem, test #441 Switch and replace if necessary.

B. Following recommended safe starting procedures, and with Parking Brake **locked** but with operator standing in the operator's compartment (not seated), attempt to start the Engine. The Engine should not start. If it does, readjust #441 Switch on #503A Mount; it's mounted too **high** in its Mount and is **closing** too soon. If readjustment doesn't solve the problem, test #441 Switch and replace if necessary. Check "expanded" height of #506 Springs (see below).

C. Following recommended safe starting procedures, and with Parking Brake **locked** and operator properly seated, attempt to start Engine. The Engine should start. If it doesn't, recheck settings of #441 Switches in Tests (A) and (B) above. Replace Module if necessary.

SEAT WEIGHT ADJUSTMENT

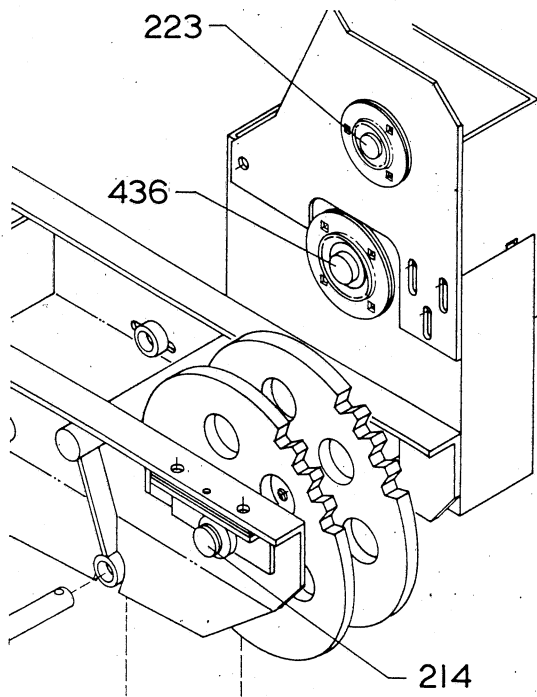
The weight of the operator required to activate the #441 Seat Switch can be adjusted by moving the pair of #506 Springs back and forth in the three sets of mating 3/8" holes located between #503A Mount and #505 Treadle.



The drawing above shows them installed in the "mid-weight" range. Use the set of holes forward for the lighter operator; use the set of holes rearward for the heavier operator.

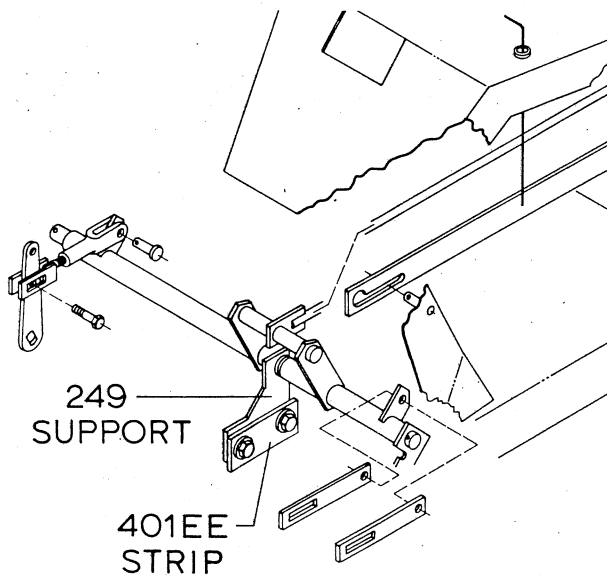
NOTE: When reassembling the #506 Springs to a new position, tighten each 3/8" Cap Screw such that it will allow each Spring to expand to only 1" high (measure Spring length only).

DRIVE CHAIN TENSIONING (#536 & 537 Chains)

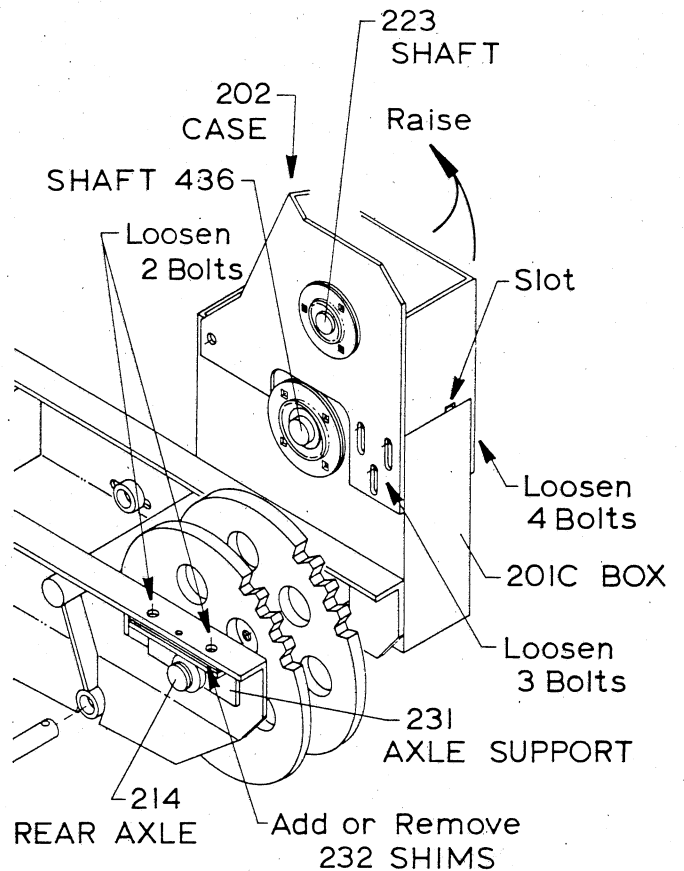


A. The #536 Drive Chain (#50 type) is tightened by increasing the center distance between the **movable** #223 shaft and the **fixed** #436 shaft.

To tighten this chain, first remove #207 Pan (remember to remove electrical plug from #441 Seat Switch). Next, "loosen" the two 3/8" Cap Screws holding the #249 Support to the #401EE Strip...fully loosen, but do not remove Cap Screws.



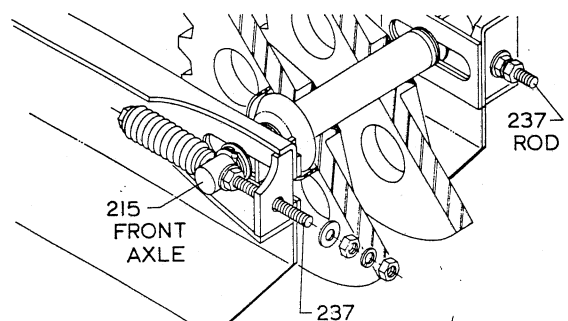
Then "loosen" the seven Bolts (three on the **outside** and four on the **inside**) on the #202 Case and rotate it upward (away from the #201C Box) until the **slack** has been removed from the Chain.



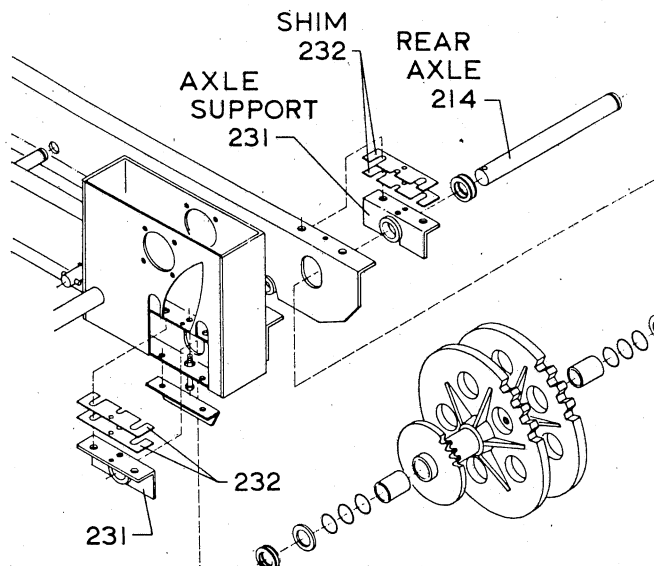
Do not make it "bow-string" tight. Secure in position by retightening the seven Bolts loosened above. **NOTE:** A screwdriver slot is provided between the Case and Box to help you make this adjustment. Make this #536 Drive Chain adjustment on **both** sides of Crawler! Now, retighten the two 3/8" Cap Screws holding the #249 Support to the #401EE Strip. Replace #207 Pan, electrical plug on Seat Switch and then start and operate Crawler. Check Drive Chain adjustment and readjust if necessary.

B. The #537 Drive Chain (#80 type) is tightened by increasing the center distance between the **movable** #214 Rear Axle and the **fixed** #436 Shaft. To tighten this Chain, first block the Crawler from beneath so that the Tracks are a few inches above the ground.

Loosen the 7/16" Nuts on the ends of each #237 Rod and allow the #215 Front Axle to slide back to the end of its slot in the Track Frame.



Loosen the two 1/2" Cap Screws holding each #231 Axle Support...fully loosen Cap Screws so that the #214 Rear Axle will drop down evenly (horizontally), but do not remove Nuts from 1/2" Cap Screws.



Add additional #232 Shims to the existing pack of #232 Shims mounted above each #231 Axle Support on each end of #214 Rear Axle. Add Shims until the #537 Drive Chain is tight...you may tap in the last shims but do not drive them in (that would indicate you are overtensioning the Chain).

NOTE: Add the same number of Shims on each end of #214 Rear Axle to make sure the Rear Axle will stay horizontal. Tighten both 1/2" Cap Screws that secure each #231 Axle Support. This tightening step will draw the Shim packs tight and create the proper slack in the #537 Drive Chain.

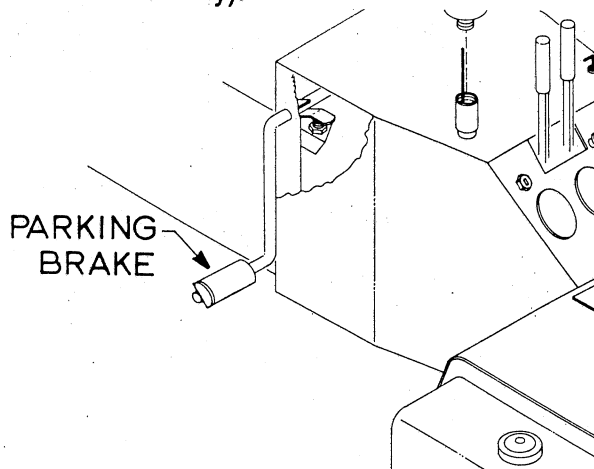
Make this #537 Drive Chain Adjustment to both sides of Crawler!

Follow Track Tensioning procedure in this manual and retension both Tracks. Remove Crawler from blocks and test run. Check Drive Chain adjustment and readjust if necessary.

PARKING/EMERGENCY BRAKE

The Parking/Emergency Brake provides a force equal to the strength of the Crawler's drive system and is used in a number of ways. One, as a Parking Brake. In this capacity, it holds the Crawler in position when the Engine and drive system is shut off.

In addition, it provides a **safe start mode**, as the Brake must be engaged before starting the Engine. If the operator inadvertently touches the Track Drive Controls during Engine starting, the Brake will overwhelm the drive system and kill the Engine (unless the Track Drive Controls are released immediately).

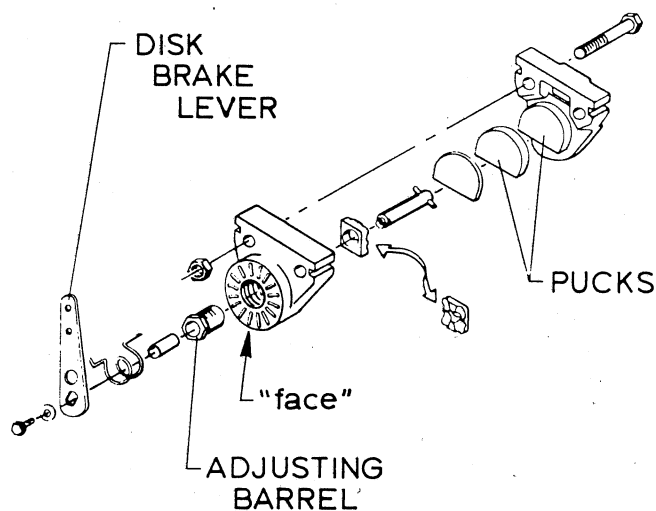


The Brake's other use is that of an Emergency Brake. If you should ever lose Engine or drive system power, the Brake can be activated instantly to hold the Crawler safely in position.

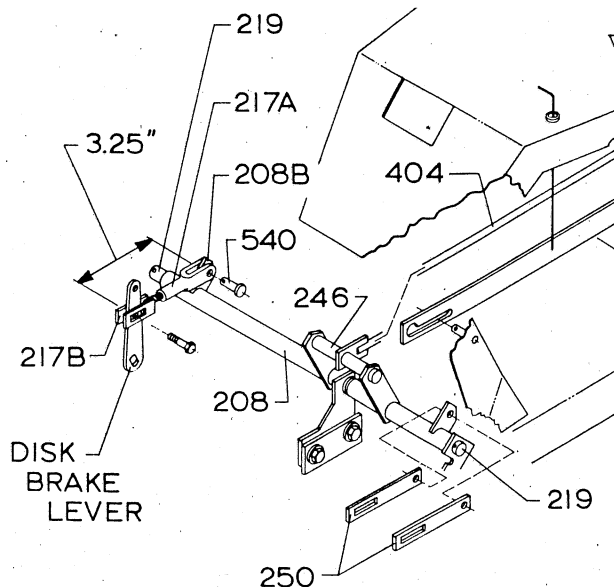
DISK BRAKE ADJUSTMENT

CAUTION: Read the following Disk Brake and Disk Puck instructions in their entirety before attempting any Disk Brake adjustments!

With the Parking Brake released, screw the adjusting barrel on each Disk Brake in (clockwise when viewing face of Brake) until it stops...don't overtighten, just tighten to the point where it stops and the pucks are tight on the Brake Disk.



Now counter-rotate (counter-clockwise) the Barrel of each Disk Brake exactly 180 degrees. The pucks should have lost their grip on their respective Disks and both Brake assemblies should be free to move.



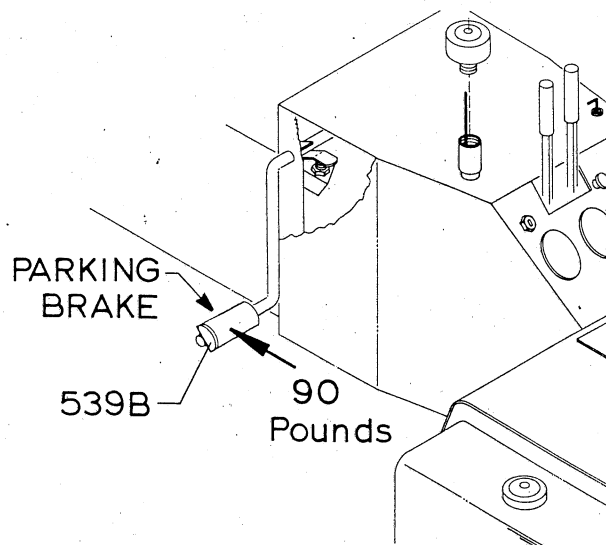
Set the length of the #217 Clevis and Yoke Assembly to 3-1/4" center to center...distance is measured from the center of the 5/16" hole in the #217A Clevis to the center of a 1/4" bolt slid to the end of the slot in #217B Yoke.

NOTE: This 3-1/4" center distance will match the similar center distance in #250 Strips. Install Clevis and Yoke by attaching #217A Clevis to #208B Arm (on #208 Rocker) with #540 Pin and secure with cotter pin.

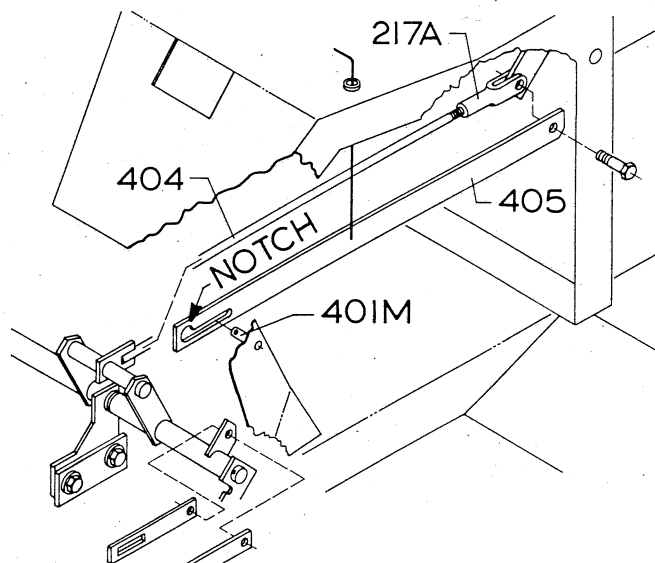
Attach #217B Yoke to Disk Brake Lever with 1/4" Cap Screw and secure with 1/4" Lock Nut...don't overtighten! Push forward on the Parking Brake and watch as each Disk Brakes' Lever begins to rotate forward, and tighten the pucks of each Brake on their respective Disk. The #246 Evener Rod is the **central pull device** that connects the two Disk Brakes together, and it **must be kept parallel** to the #219 Pivot Rod.

If it is not parallel, remove the #540 Pin from the #217A Clevis and rotate the Clevis to a new setting which will now keep the #246 Evener Rod parallel to the #219 Pivot Rod. When satisfied, secure #540 Pin with cotter pin.

With a **spring scale** attached to #539B Pedal, draw Parking Brake forward with a force of approximately 90 pounds.



At this point, notch in slot of #405 Bar should drop over mating #401M Pin.



If it doesn't, then disconnect 5/16" Cap Screw holding #217A Clevis on forward end of #404 Pull Rod and screw Clevis further **off** Rod. Remount Clevis and check. If notch drops over Pin before spring scale reaches 60 pounds, screw Clevis further **on** Rod and then reassemble and check.

When satisfied, secure 5/16" Cap Screw holding #217A Clevis and #405 Bar with 5/16" Lock Nut. Don't overtighten; Cap Screw must be able to rotate.

DISK PUCK ADJUSTMENT

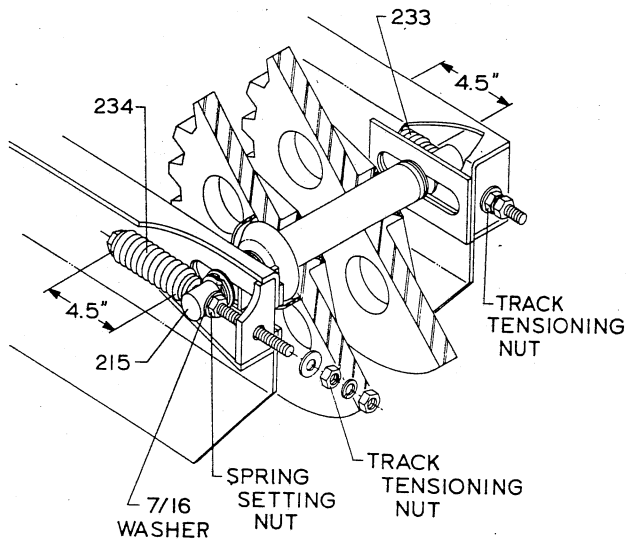
After the Disk Brakes have been initially set correctly per instructions (above), subsequent Disk Puck wear can be compensated for by turning the Adjusting Barrel of each Disk Brake **clockwise** (while looking at **face** of Disk Brake) 1/6 turn at a time.

This adjustment must be done to both Disk Brakes to keep the #246 Evener Rod parallel to the #219 Pivot Rod when the Brakes are activated.

NOTE: The Adjusting Barrel of one Disk Brake may potentially be adjusted more than the other due to uneven Brake puck wear. It is mandatory that when the Brake Pedal is released, that each Disk Brake's **puck** is fully released and the Disk Brake assemblies are free to move without any appreciable **drag** on their respective Disks.

TRACK REMOVAL

Block Crawler from below so that Tracks clear the ground by 2". **NOTE:** Use solid "blocking" and place it under the Crawler so that it will give the Tractor the greatest support left to right and front to rear. When placing your "blocking", analyze the total weight and balance of the Crawler as it will change as various Attachments are added and removed!



Loosen and remove the Track Tensioning Nuts on each end of #215 Front Axle so that the Front Axle can slide rearward to the **end** of its slots. With gloved hands, rotate Track forward while at the same time forcing it **outward** to derail its "chain" from its dual Front Sprockets.

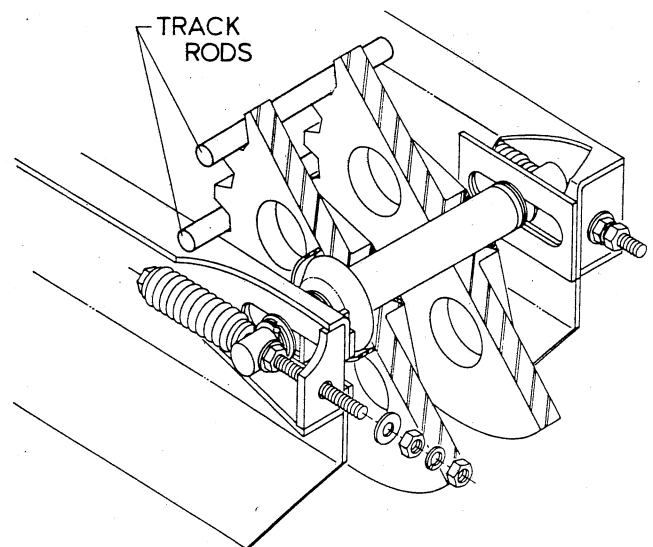
Once the Track's **outside** "chain" has derailed from its first Front Sprocket, reverse the procedure and rotate the Track rearward and derail the Track's **outside** "chain" outward and off its first Rear Sprocket.

Returning to the front of the Crawler again, rotate the Track forward and derail the Track's **inside** "chain" up and off the remaining Front Sprocket. In the rear, loop the balance of the Track off the remaining Rear Sprocket.

TRACK REPLACEMENT

To replace the Track, you basically reverse the process of Track Removal as described above.

When you get to the last step (where the two Rear Sprockets have their teeth engaged into their respective Track "chains"), with gloved hands roll the Track forward. As you do, insert each of six 5/8" diameter x 9" long Track Rods into the "valleys" between **every other** tooth of the dual Front Sprockets. All Rods enter where top strand of Track "chain" is entering the upper teeth of the two dual Front Sprockets.

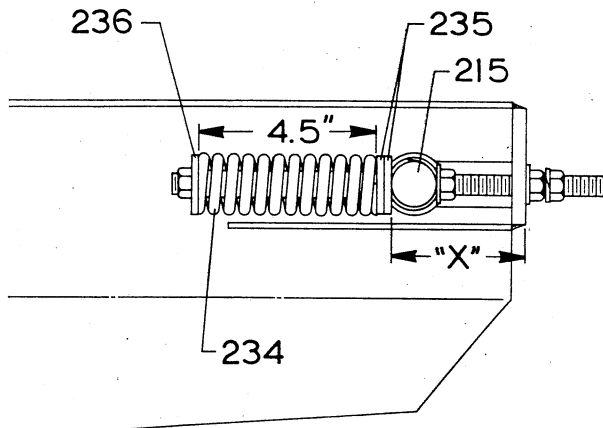
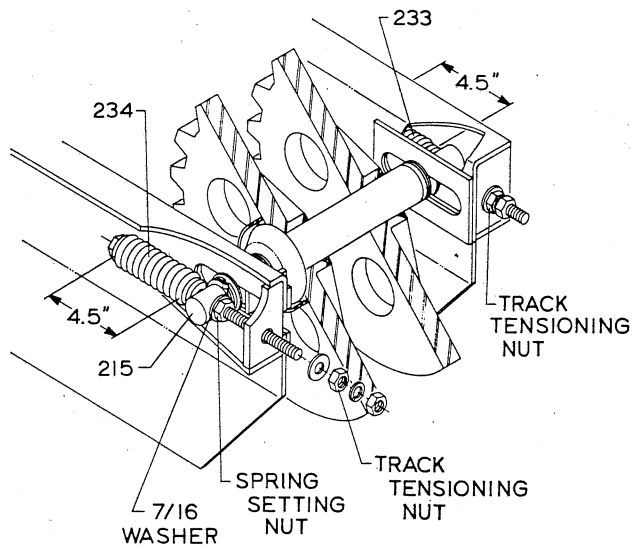


When all six Rods are in place, you can easily slide the Track assembly **inward** and align the two Track "chains" with their mating dual Front Sprockets. When aligned, roll Track rearward and remove each Rod as it drops free. Follow **TRACK TENSIONING** steps to properly tension your Tracks.

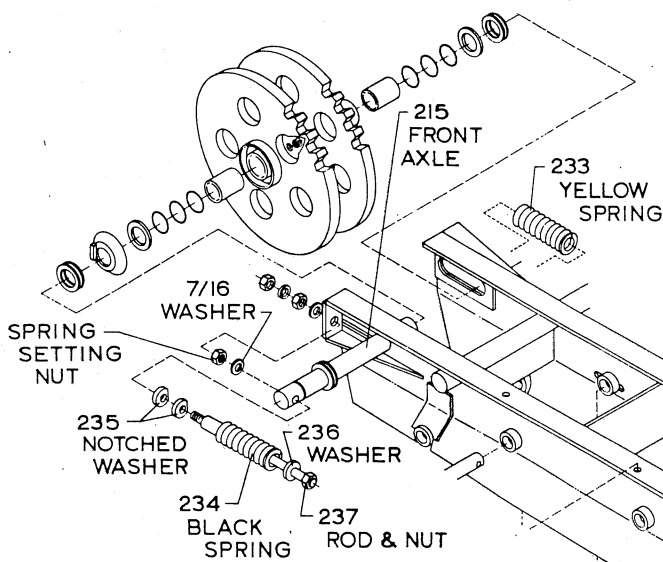
TRACK TENSIONING

Begin your tensioning procedure by checking the overall length of the #234 Black Spring and #233 Yellow Spring. Both Springs should be compressed to an overall length of 4-1/2" (the length measured is only the Spring; do not include

the #236 and #235 Washers in your measurement!)



If your Springs have lost this 4-1/2" dimension, or you have replaced a broken #237 Rod, follow this procedure:



Hold the 7/16" Nut (welded to rear end of #237 Rod) with a wrench while turning the 7/16" Nut (Spring Setting Nut) pressing against a 7/16"

Washer and against the front face of the #215 Front Axle. Compress Spring to a 4-1/2" overall length.

Mark on Rod where Spring Setting Nut is resting for this 4-1/2" setting; then turn Nut further in, a distance of the thickness of the Nut. On the Rod (in the area where the nut rested to hold its 4-1/2" dimension), take a center punch and upset the threads in a number of places. Now back off the Nut and reset your 4-1/2" Spring length...this should now remain a permanent setting.

NOTE: In tests, this procedure has restrained the Spring Setting Nut and held the required 4-1/2" dimension. If your particular application causes this Nut to lose its setting, then in a similar manner as above, substitute a layer of "Locktite" in the area where you would have upset the threads above. **NEVER** weld this Nut into position as you will need the "unscrewing" method of safely decompressing the Spring when it comes time to replace the Front Axle.

With your Springs now properly set, begin to tension your Tracks. Tighten the Track Tensioning Nut (7/16" Nut closest to the #201G Quadrant on each end of #215 Front Axle).

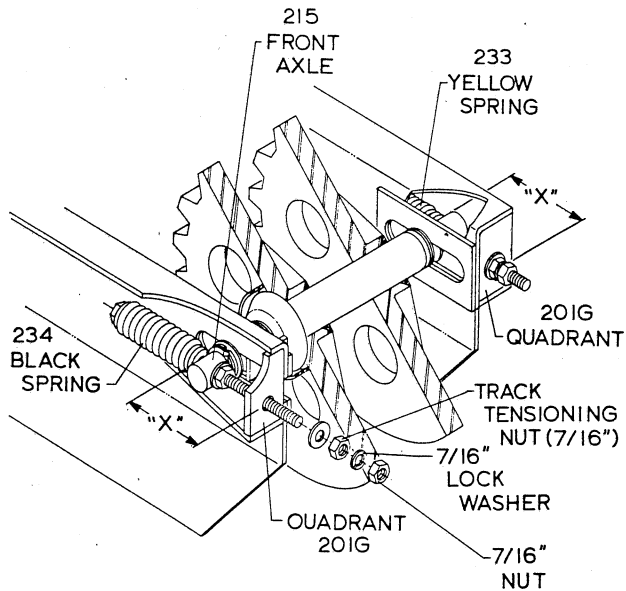
In your tightening, work back and forth from one end of the Axle to the other to keep the Axle drawing forward, parallel to the Rear Axle. Keep drawing the Axle straight forward until the 7/16" Washer "sandwiched" between the Spring Setting Nut (located in Spring Setting steps above) and the front face of Front Axle (on the Black Spring side of Front Axle) is just loose enough to be rotated with your fingers.

Now, counter-rotate the Track Tensioning Nut (on Black Spring side) for one full turn...the 7/16" Washer should now be tight and no longer able to be rotated with fingers.

Hold this Nut (the Track Tensioning Nut on Black Spring side of Axle) with an open end wrench; then secure its position with a 7/16" Lock Washer and a second 7/16" Nut. Tighten, but do not allow Track Tension Nut to rotate and lose its setting.

With the Track Tensioning Nut locked in position (on the Black Spring end of Front Axle) determine the "X" dimensions as shown in drawing. This "X" dimension is the distance from

the front face of the #201G Quadrant to the rear face of the #215 Front Axle.



After this "X" dimension is determined, set an identical dimension noted as "X" on the other end of the Front Axle (Yellow Spring end of the Front Axle). In a similar manner as above, lock the Track Tensioning Nut (on the Yellow Spring end of Front Axle) with a 7/16" Lock Washer and Nut.

Recheck "X" distances on Yellow and Black Spring ends of #215 Front Axle. If they are not identical, repeat tensioning procedure.

INSTRUCTIONAL NOTE:

On all Crawler tractors, the **greatest cause** of bearing wear in the Front and Rear Sprockets is from the **spring tensioning** of the Track...not from supporting the weight of the Crawler and its Attachments.

To greatly reduce the "spring tensioning loads" on the Sprocket bearings, the Track Springs' tension is **preloaded**...that's the procedure you did (above) by setting the Springs to a 4-1/2" overall dimension. This preloading presets the force the Springs will apply when called on due to heavy debris getting caught in the Track and requiring the track system to recoil under Spring pressure.

As long as the 7/16" Washer (resting against the front face of #215 Front Axle) is tight and not able to be finger-rotated, the full pressure of the Spring has not been applied and the only Track loading against the bearings is that required to take up the slack in the Track's "chain".

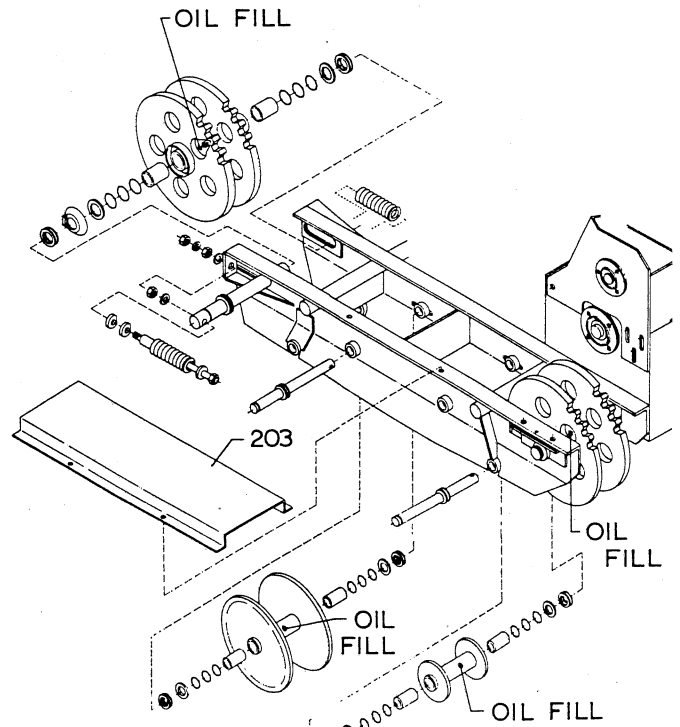
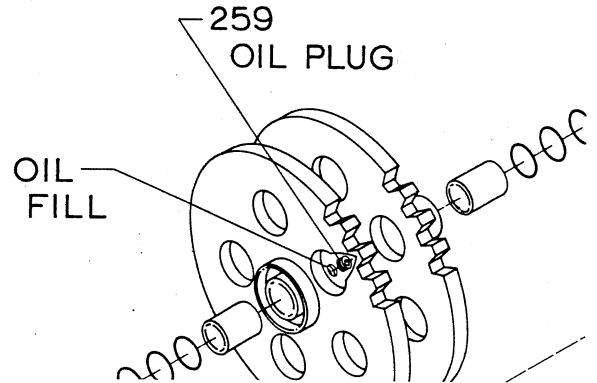
In all situations, the looser you can keep your Track's tension, the less wear you will cause to the bearings. Try to find that balance between minimum Track tension and reliable Track stability for the various ground conditions you will be encountering.

TRACK SPROCKET AND IDLER LUBRICATION

Safely block up Crawler, remove both #203 Covers and remove both Tracks.

A. Using a high-pressure washer, clean Track joints and mud relief holes.

B. Similarly clean Track Sprockets and Idlers concentrating around #259 Oil Plug on mounting tube of each Track Sprocket and Idler.



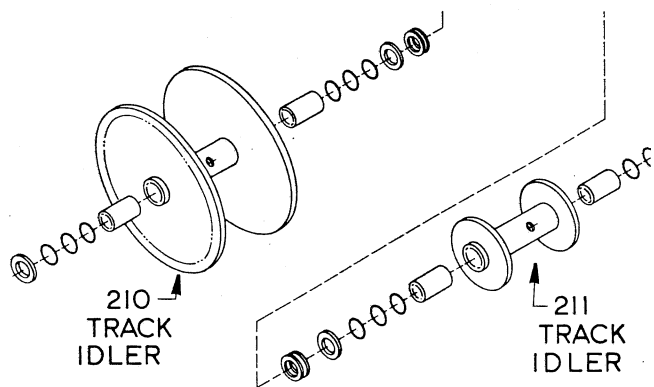
C. With each Oil Plug in the **top dead center** position, use a hex wrench and remove each Plug.

D. Fill each oil hole with SAE10 or SAE30 weight oil (depending on the season) and replace and securely tighten each Oil Plug.

E. Replace and retension Tracks per Track Tensioning instructions. Replace both #203 Covers using original Cap Screws. Remove blocks from under Crawler.

NOTE: After performing this maintenance step a few times, you may discover that the oil reservoir of each Sprocket and Idler is still full. This may indicate that your working environment may be of the type that will allow you to go 75 to 100 hours between oilings. **Never go beyond 100 hours.**

NOTE: The #210 and #211 Track Idlers are made of a somewhat softer steel than the Track Chain. This has been done to allow the inevitable wear to be concentrated on the less expensive Idlers thereby protecting and greatly extending the life of the much more expensive Track Chain.



The Track Idlers, after a few hours of running time, will have their inside walls **hard-peened** into a configuration that will precisely mate with the contour of the Track Chain they are guiding. This **peening** process creates not only a mating inside surface on each Idler, but also rolls a wider extended edge around each Idler's circumference. In addition, the Idler surfaces are "work hardened" by being **peened** against the harder Track Chain.

TRACK SHOES

Your Crawler comes from the factory without any Track Shoes being installed. You can safely run your Crawler without Track Shoes, but under

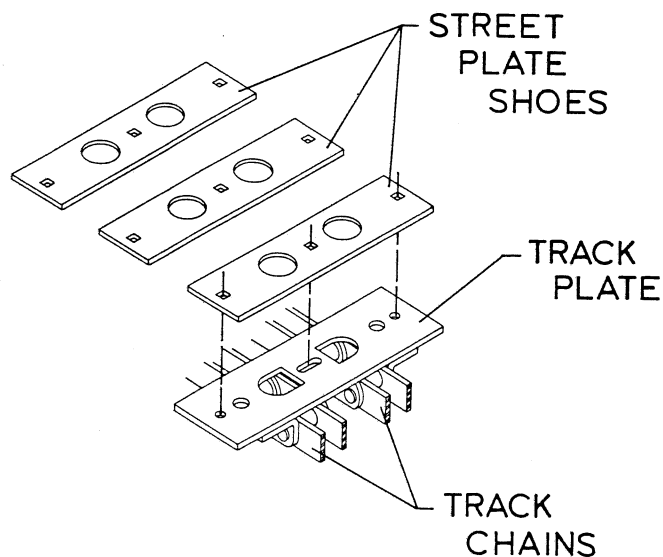
average soil conditions you will be able to attain only about 80% of your Crawler's tractive ability.

To gain more traction, you can add either Street Plate Shoes (included with your Crawler) or Grouser Shoes (TO20 Option). Under average soil conditions the addition of Street Plate Shoes to your Track will increase traction to approximately 90% of your Crawler's tractive ability. Adding Grouser Shoes will give you the greatest tractive ability your Crawler can deliver.

STREET PLATE SHOE INSTALLATION

Provided with your Crawler is a set of Street Plate Shoes complete with 3/8x1" Carriage Bolts and 3/8" Flange Lock Nuts. A single Street Plate Shoe is applied to the **top outside face** of each Track Plate and held in position with three 3/8x1" Carriage Bolts and three 3/8" Flange Lock Nuts.

NOTE: The Carriage Bolts are inserted into the 3/8" **square** holes in **top outside face** of each Street Plate Shoe and the 3/8" Flange Lock Nut is applied to the protruding end of each Carriage Bolt on **lower inside face** of each mating Track Plate.

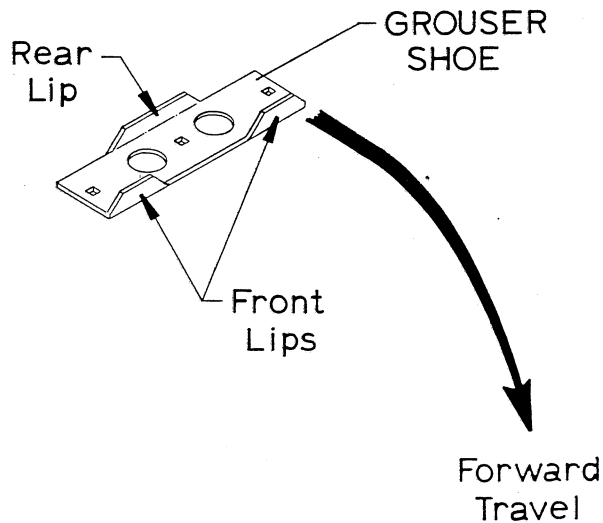


The Street Plate Shoes will provide a significant increase in Track traction, but will create a modest increase in Track vibration when traveling over hard, unyielding surfaces such as concrete, asphalt, etc.

GROUSER SHOE INSTALLATION

Grouser Shoes **must** be installed properly to avoid damage to the Crawler and potential operator injury! Each Grouser Shoe has two

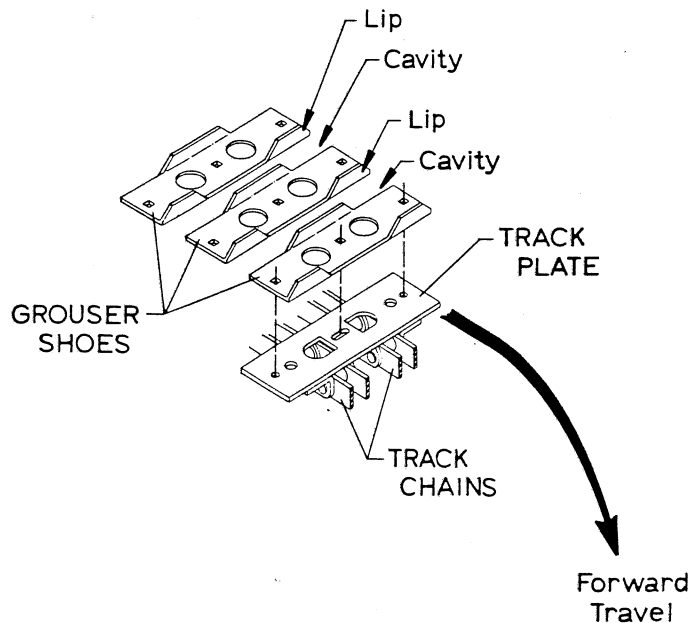
Front Lips and one **Rear Lip**. Grouser Shoes **must** be installed so that the two **Front Lips** of each Shoe touch the ground **first** during **forward** travel!



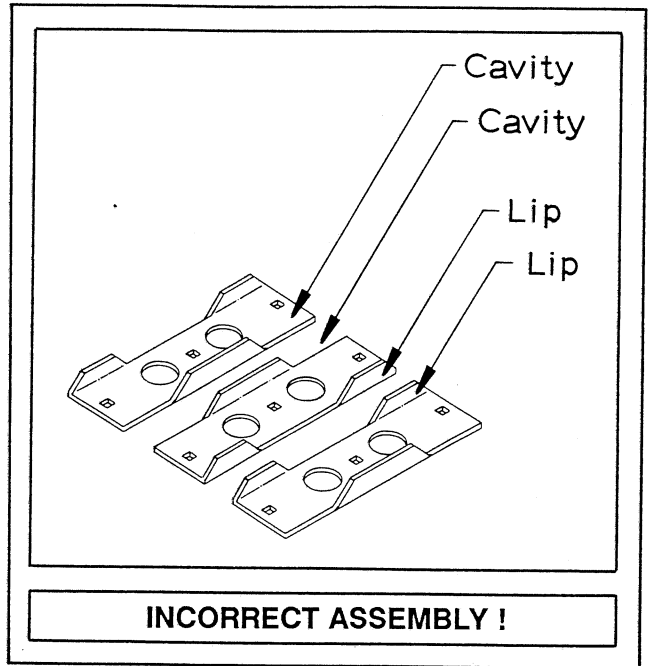
Grouser Shoes are applied to the **top outside face** of each Track Plate and held in position with 3/8x1" Carriage Bolts and 3/8" Flange Lock Nuts.

NOTE: The Carriage Bolts are inserted into the 3/8" **square** holes in **top outside face** of each Grouser Shoe and the 3/8" Flange Lock Nut is applied to the protruding end of each Carriage Bolt on **lower inside face** of each mating Track Plate.

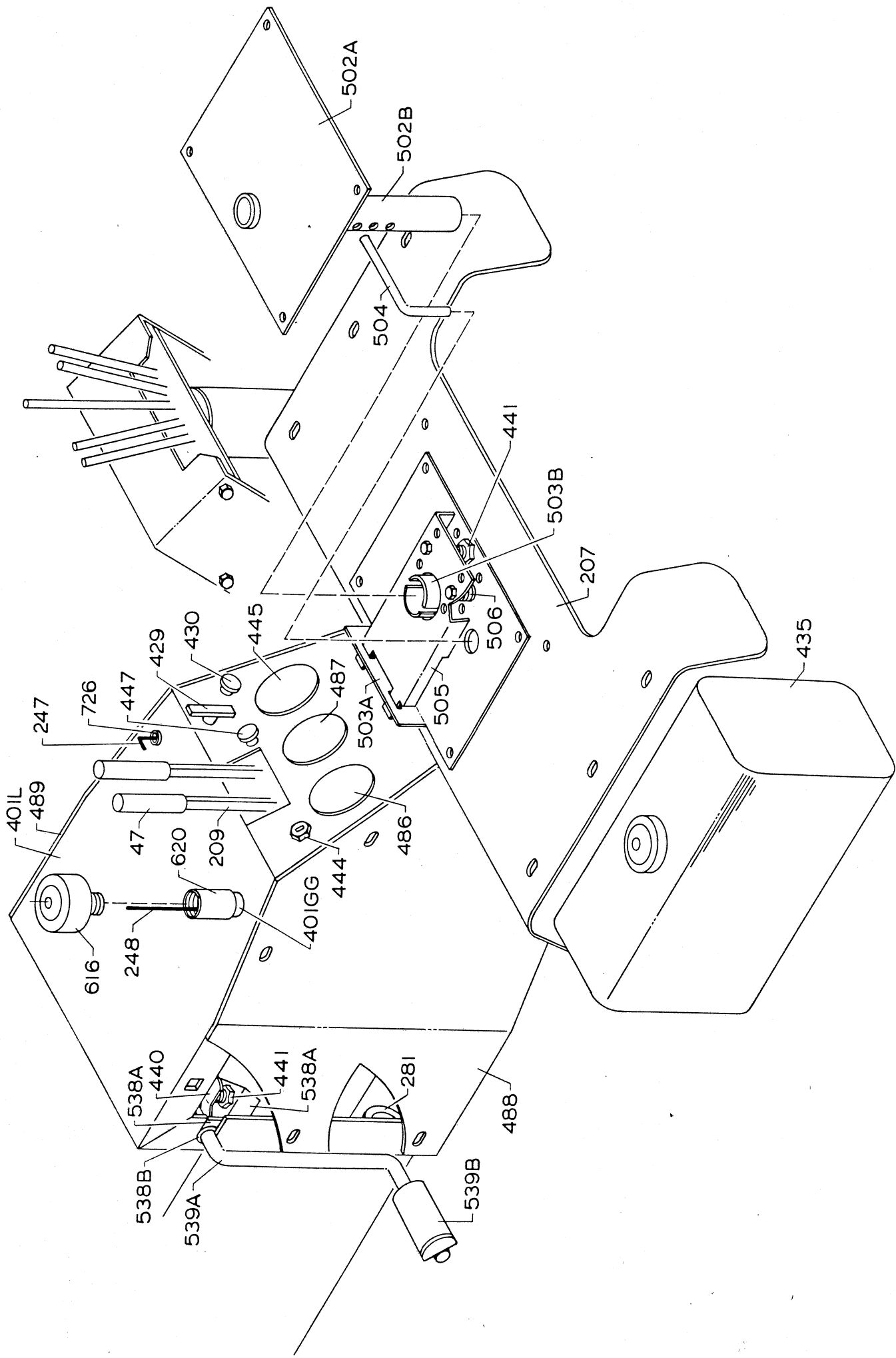
The **Lip** of one Shoe should **always** be followed by the **Cavity** of the next Shoe in line. Carefully study the drawing below.

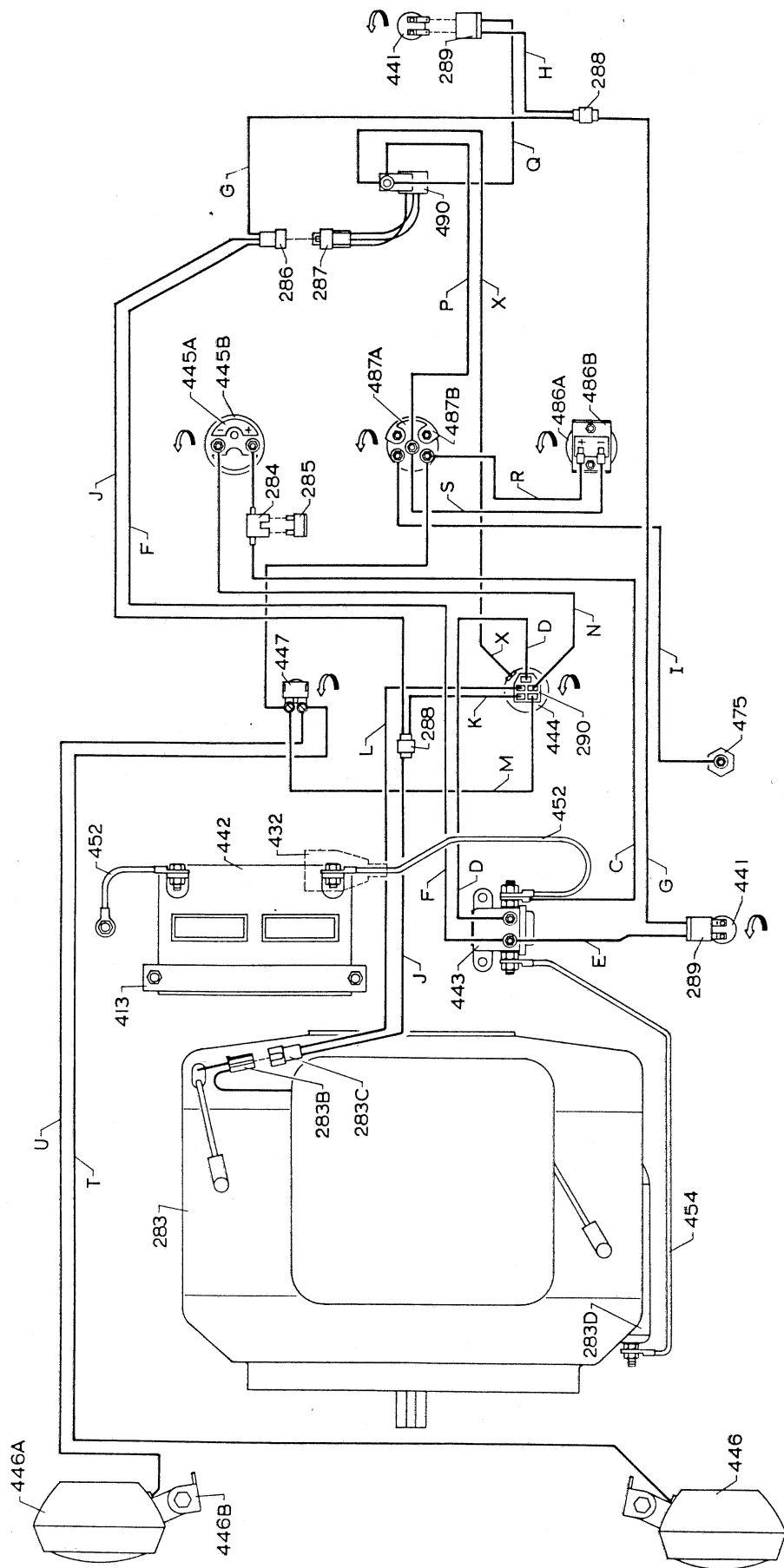


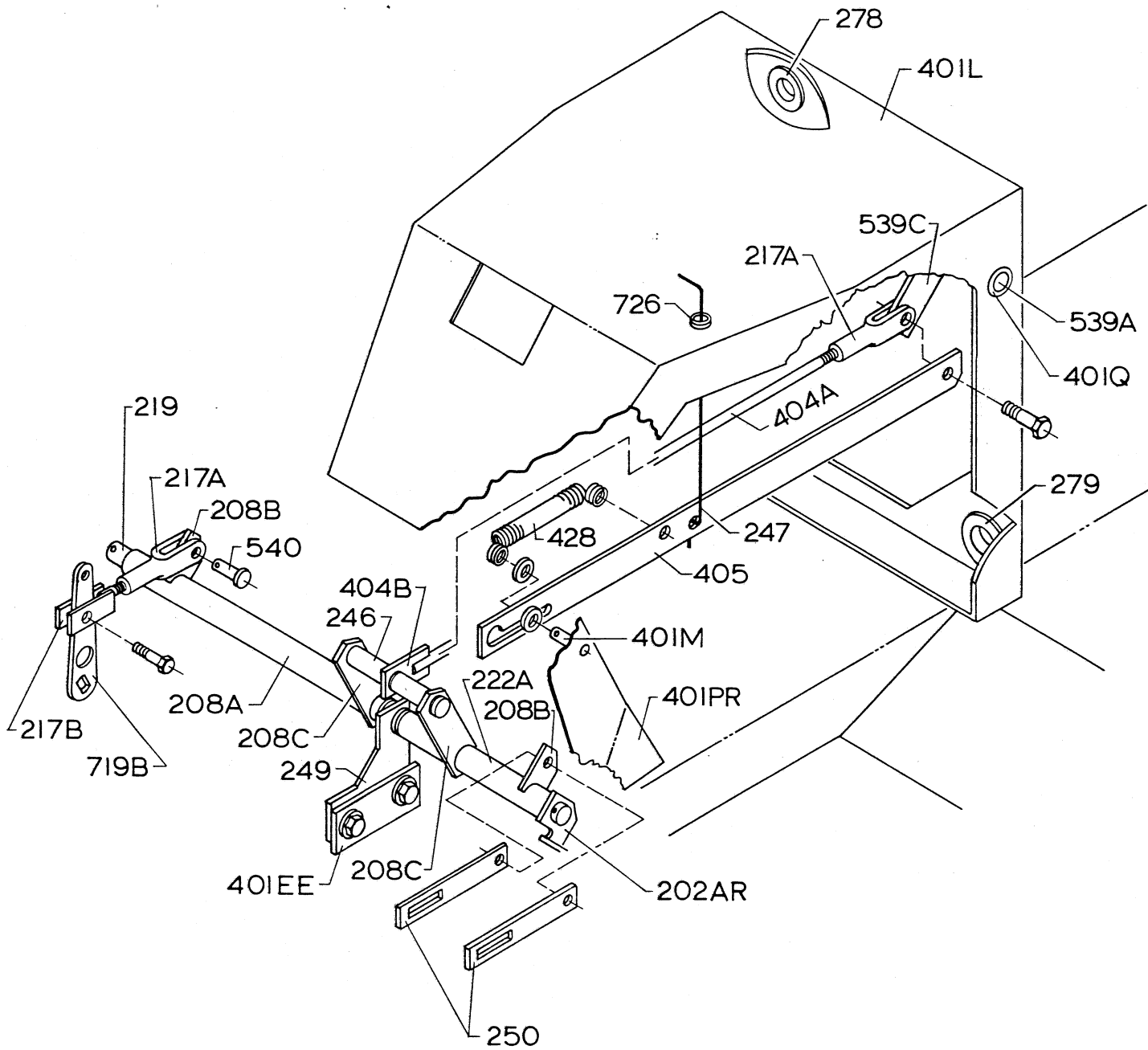
CAUTION: Incorrect assembly of the Grouser Shoes is shown in the drawing below. The **Lip** of one Grouser Shoe **should never** be followed by the **Lip** of the next Grouser Shoe in line. The **Cavity** of one Grouser Shoe **should never** be followed by the **Cavity** of the next Grouser Shoe in line.

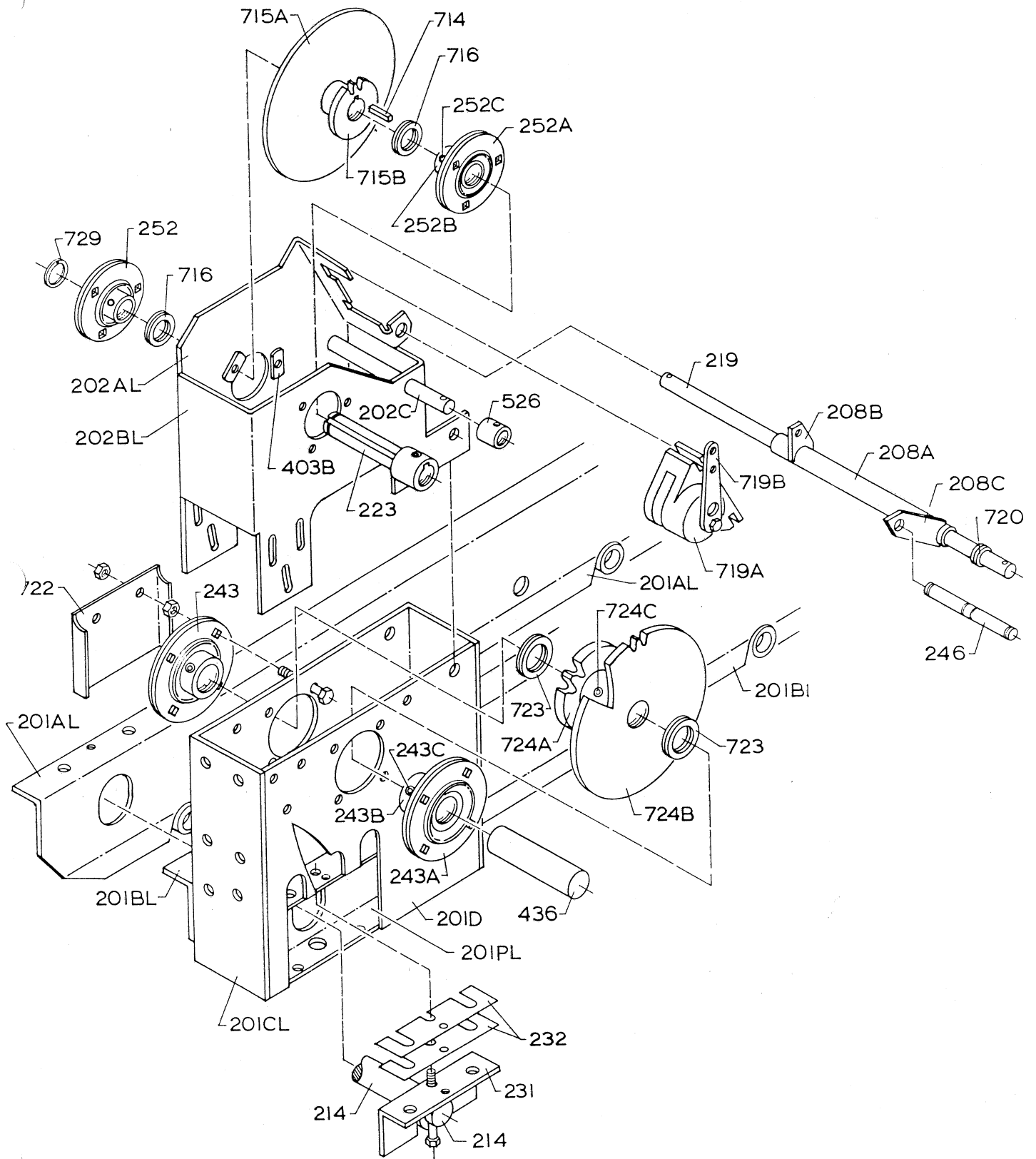


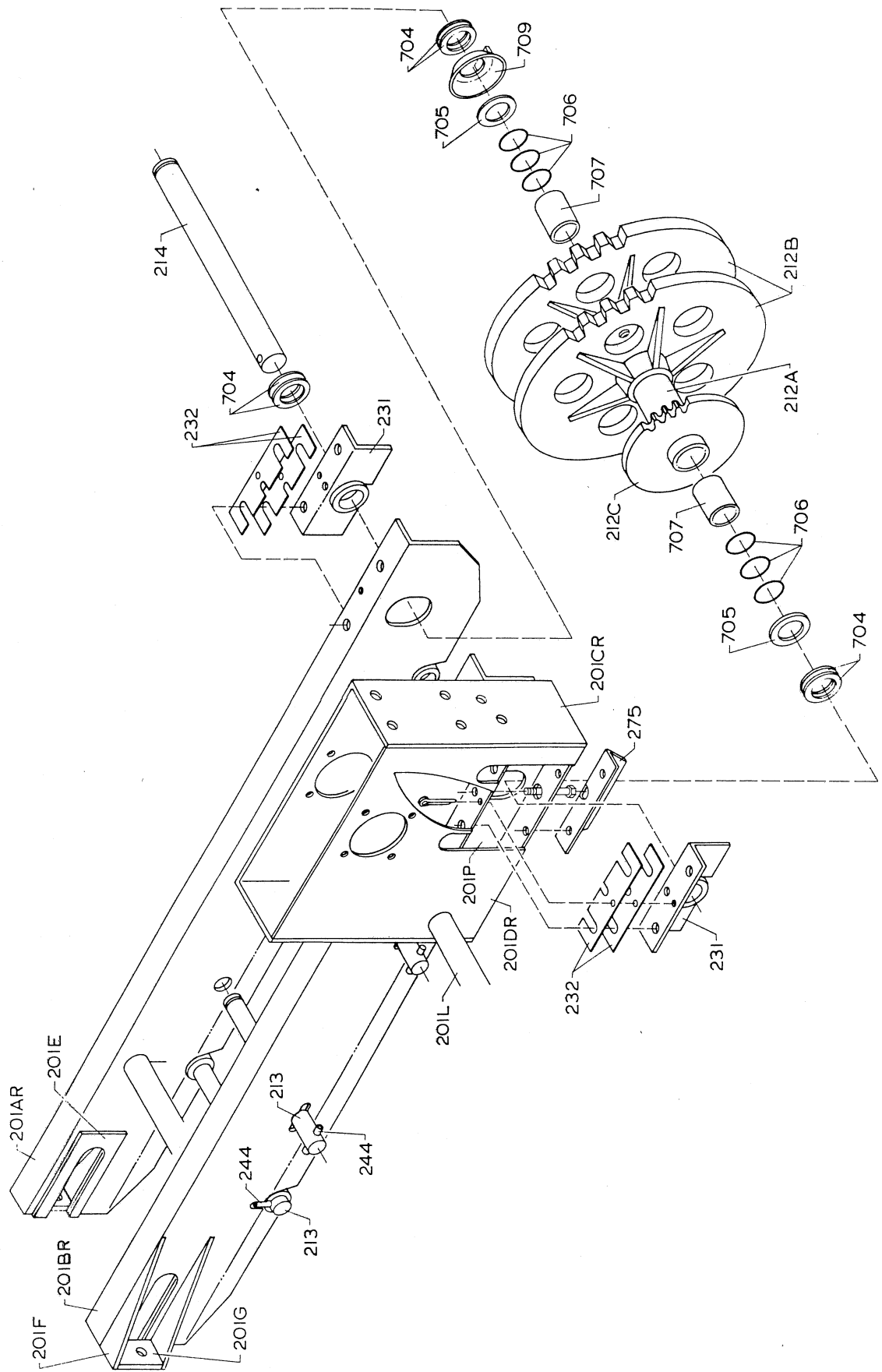
If the Grouser Shoes are installed incorrectly, mud, stones, etc. can build up between the **Lips** of two adjacent Grouser Shoes causing the Track Chain to loose its ability to flex. This results in the Track rising up and striking and potentially causing damage to the Crawler's Fenders and related parts and possible operator injury.











TRACKED VEHICLE — Operation & Procedure

A Tracked Vehicle, by its very nature, requires the use of operating techniques and procedures that are unfamiliar to most people used to driving wheeled vehicles.

This means that a person intending to operate a Tracked Vehicle must allow himself ample opportunity to familiarize himself with the controls and characteristics of the machine.

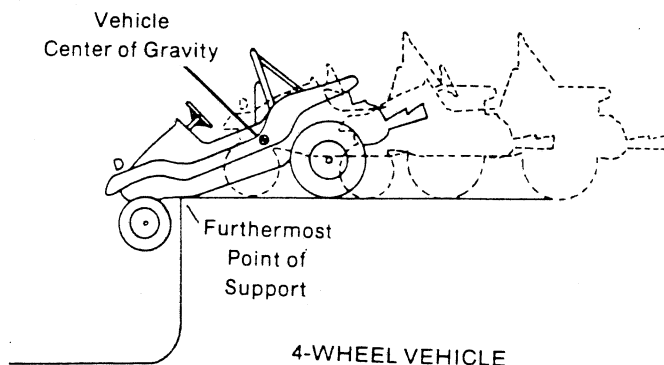
It is the purpose of this booklet to inform and instruct prospective Tracked Vehicle operators in an effort to help them use it safely.



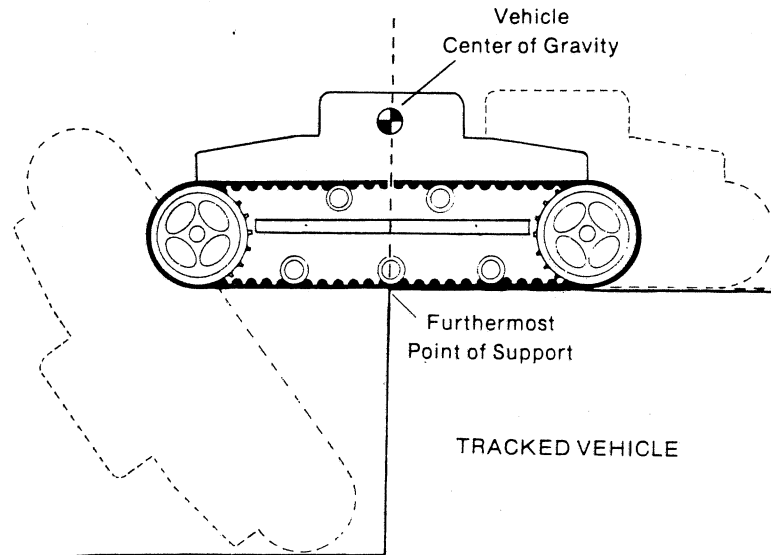
SAFETY WARNING: NO PERSON SHOULD ATTEMPT TO OPERATE A TRACKED VEHICLE BEFORE READING THIS BOOKLET THOROUGHLY. IF ANY PORTION OF THIS BOOKLET IS NOT CLEARLY UNDERSTOOD, WRITE TO US AT THE ADDRESS ON THE FRONT COVER.

TRACKED VEHICLE CHARACTERISTICS

Tracked vehicles possess certain inherent features not found on standard four-wheel vehicles. For instance, a standard vehicle will hit bottom when the wheels on either end are driven over a drop-off. In most cases this will stop vehicle motion and give immediate warning.

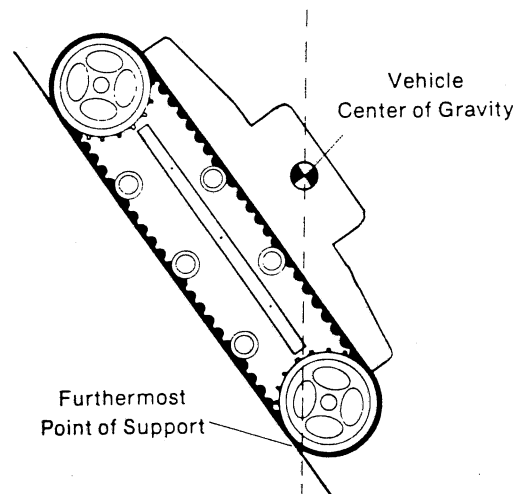


A Tracked Vehicle, however will continue on without any warning until its center of gravity passes across an imaginary line drawn straight up from the furthestmost point of support with the ground. It will drop **SUDDENLY**. (See illustration upper right). **THIS WILL HAPPEN EVEN AT THE VERY SLOWEST SPEEDS.**



SAFETY WARNING: ANYTIME A PORTION OF THE TRACK IS NOT IN CONTACT WITH THE GROUND, STABILITY IS REDUCED. NEVER ATTEMPT TO 'JUMP' A TRACKED VEHICLE OVER DROP-OFFS, HILL CRESTS, OR OTHER OBSTACLES. THIS CAN BE EXTREMELY HAZARDOUS.

A Tracked Vehicle can climb or descend steep slopes, so steep in fact that the vehicle can tip over forward or backward, before it loses traction.



Tipover occurs when the Vehicle's center of gravity passes across an imaginary line drawn straight up from the furthestmost point of support with the ground.

When the Vehicle's center of gravity passes this point, the vehicle will tip over **SUDDENLY**.

TRACKED VEHICLE OPERATION

A Tracked Vehicle, by its very nature, is a vehicle requiring a great degree of care and judgment during operation. It should be kept in mind that while your Tracked Vehicle is designed to operate in rough terrain, this same fact allows for the possibility of a hazardous condition developing at any time. Safe operation of your Tracked Vehicle must be based on the understanding of the vehicle's limitations, thorough knowledge of the controls and their functions, and the operator's good judgment and experience.



SAFETY WARNING: WHERE THE OPERATOR IS NOT CERTAIN OF THE VEHICLE'S ABILITY TO TRAVERSE AN OBSTACLE OR TERRAIN SITUATION, OR; IS NOT CERTAIN OF HIS OWN ABILITY TO SAFELY OPERATE THE VEHICLE, AN ALTERNATE ROUTE MUST BE TAKEN.

OPERATION ON SLOPES

Tracked Vehicle operation on slopes presents an obvious opportunity for the vehicle to tip over. This type of operation demands constant attention to changes in terrain and the ability to anticipate and avoid possible hazards.

This ability can only be developed through careful study of the points noted in this section and a slow, planned effort on the operator's part to become proficient.

The most effective guard against hazards while operating on slopes, especially during downhill operation is to keep vehicle speed very slow.



SAFETY WARNING: WHEN OPERATING ON SLOPES VEHICLE SPEED SHOULD BE KEPT VERY SLOW AND THE OPERATOR SHOULD BE EXTREMELY ALERT FOR CHANGES IN TERRAIN.

Vehicle stability on a hill, for example, is determined not only by the general slope of the hill but also by terrain conditions (rocks, ditches, logs, drop-offs, etc.)-and by the nature of the hill surface (gravel, sand, grass, snow, rock, etc.), the payload which the vehicle is carrying, the manner in which the payload is distributed within the vehicle, attachments and accessories which have been added to the vehicle, and so forth.

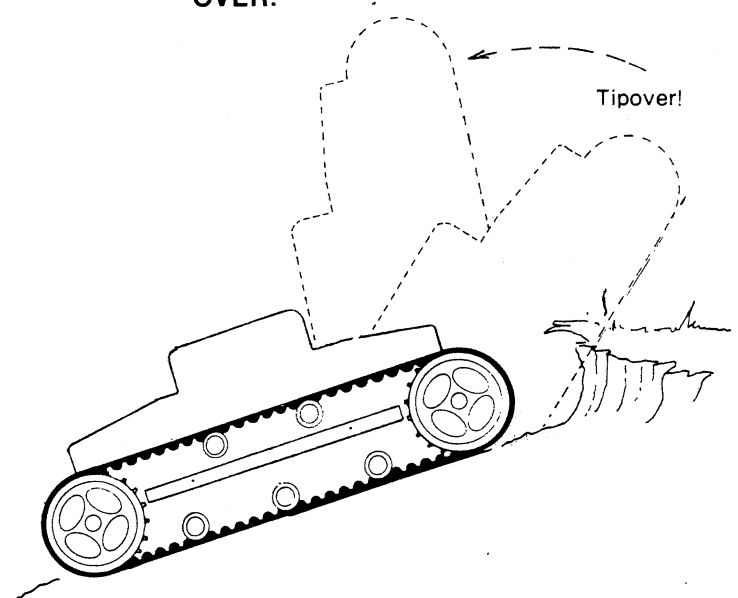
Similarly, driving technique and its effect on vehicle stability enters into any determination of what constitutes a safe slope. Excessive speed, sudden braking, choice of path - all can be critical.

UPHILL OPERATION

The following illustrations depict some situations in which a Tracked Vehicle can be expected to tip over. Variations in speed, loading, terrain and vehicle condition must all be analyzed to determine whether or not a specific obstacle can be traversed. If in doubt, do not attempt.

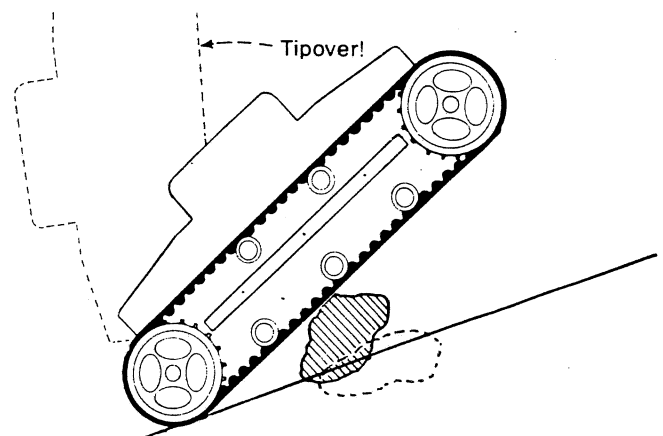


SAFETY WARNING: ON STEEPER SLOPES SMALLER OBSTACLES WILL CAUSE A TRACKED VEHICLE TO TIP OVER.



It is common to see a situation where natural erosion has caused the very top of a bank or hill to rise sharply. Always check for this condition before attempting to climb any such type of terrain. A Tracked Vehicle could climb up to a point at which it falls over backward.

It is also very important to check for this terrain condition before going down over the edge of a bank or dropoff.



The same situation can occur where an imbedded object is pulled from the ground. The vehicle track may 'grab' a rock or log. As the object emerges from the ground, rolling under the track, the vehicle could climb to the point at which it falls over backward.

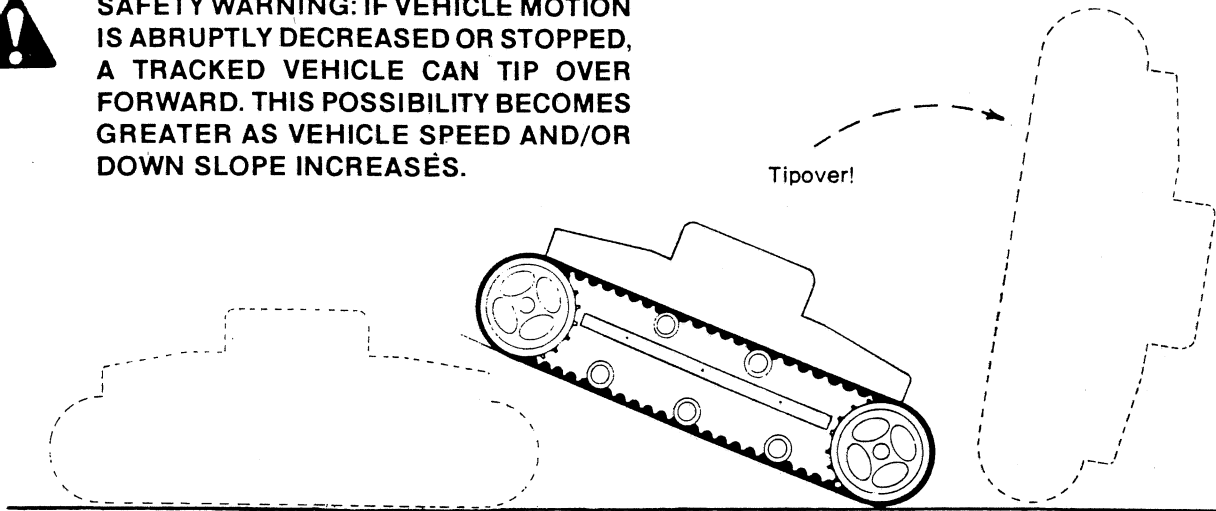
DOWNHILL OPERATION

SUDDEN STOPS

If a Tracked Vehicle is driven down a slope and the tracks are stopped suddenly, the vehicle's exceptional traction may cause it to tip over forward.



SAFETY WARNING: IF VEHICLE MOTION IS ABRUPTLY DECREASED OR STOPPED, A TRACKED VEHICLE CAN TIP OVER FORWARD. THIS POSSIBILITY BECOMES GREATER AS VEHICLE SPEED AND/OR DOWN SLOPE INCREASES.

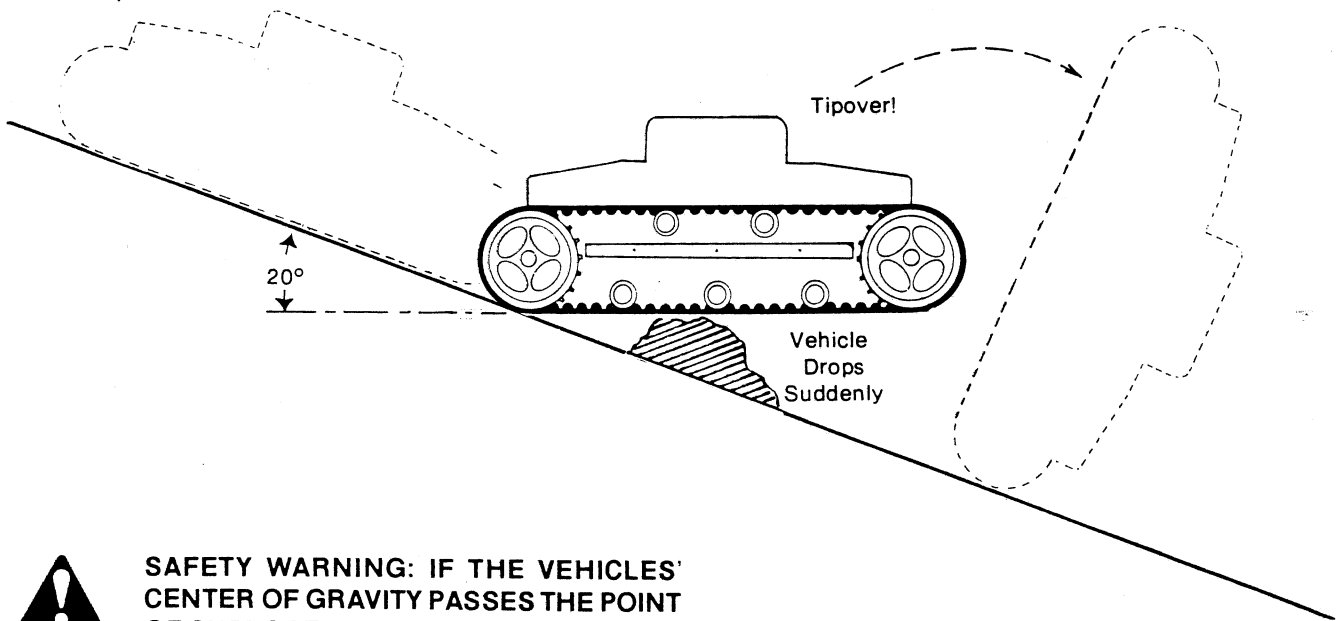


CROSSING OVER AN OBJECT

This illustration is drawn to depict an obstacle situation in which a Tracked Vehicle can be expected to tip over. Variations likely to occur in natural terrain, the approach to the obstacle, operator skill and loading of a Tracked Vehicle may reduce the size of obstacle or steepness of the slope required, which could cause tipover.



SAFETY WARNING: ON STEEPER SLOPES, SMALLER OBSTACLES WILL CAUSE A TRACKED VEHICLE TO TIP OVER.



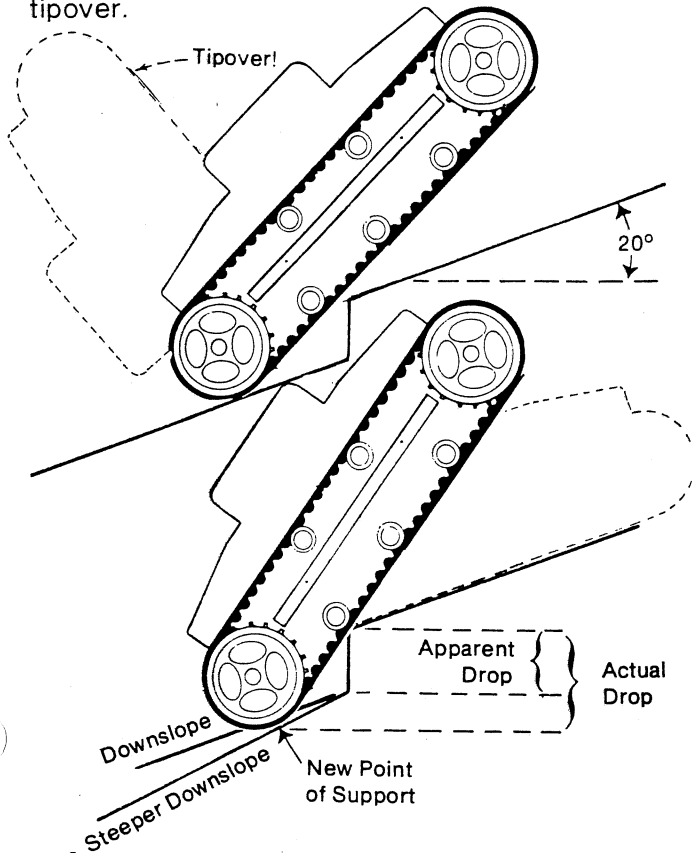
SAFETY WARNING: IF THE VEHICLES' CENTER OF GRAVITY PASSES THE POINT OF SUPPORT, A TRACKED VEHICLE WILL BEGIN TO TIP. UNLESS THE TERRAIN ON THE DOWNSIDE OF THE OBJECT PROVIDES A NEW POINT OF SUPPORT, FAR ENOUGH AHEAD OF THE VEHICLE CENTER OF GRAVITY TO NEGATE THE EFFECT OF INERTIA, A TRACKED VEHICLE WILL TIP OVER FORWARD.



SAFETY WARNING: OBSTACLES, SOME OF WHICH MIGHT BE DRIVEN OVER SAFELY WHILE ON LEVEL TERRAIN, CAN CAUSE A HAZARD WHILE OPERATING ON SLOPES.

DROPOFFS

This illustration is drawn to depict a dropoff situation in which a Tracked Vehicle can be expected to flip. Variations occurring in natural terrain, the approach to the obstacle, operator skill, and loading of a Tracked Vehicle may reduce the size of the drop-off or the steepness of the slope, which could cause tipover.



SAFETY WARNING: A TRACKED VEHICLE MUST BE OPERATED WITH GREAT CARE AT ALL TIMES AND ON ANY SLOPE. SLOPES STEEPER THAN 20° SHOULD BE REGARDED AS ULTRA-HAZARDOUS AND APPROACHED WITH EXTREME CAUTION. EVEN ON SLOPES OF LESS THAN 20°, A TRACKED VEHICLE CAN BE TIPPED OVER BY A SUDDEN STOP, EXCESSIVE SPEED, UNEVEN TERRAIN, OR OTHER SPECIAL CONDITIONS OR COMBINATIONS OF SUCH CONDITIONS.

An important variable in determining if a given obstacle will cause a Tracked Vehicle to tip over is the vertical distance between the last point of contact and the new point of support. Note that the new point of support can be on level ground, a downhill slope, or a steeper downhill slope. The apparent size of the obstacle or dropoff is not the same as the drop it causes. Among the many other variables are the steepness of the slopes, size of the obstacle causing the drop, the shape of the last point of support, the load on the Tracked Vehicle, initial speed, tightness of the track, traction, symmetry of the obstacle to the Tracked Vehicle and operator skill and judgment.

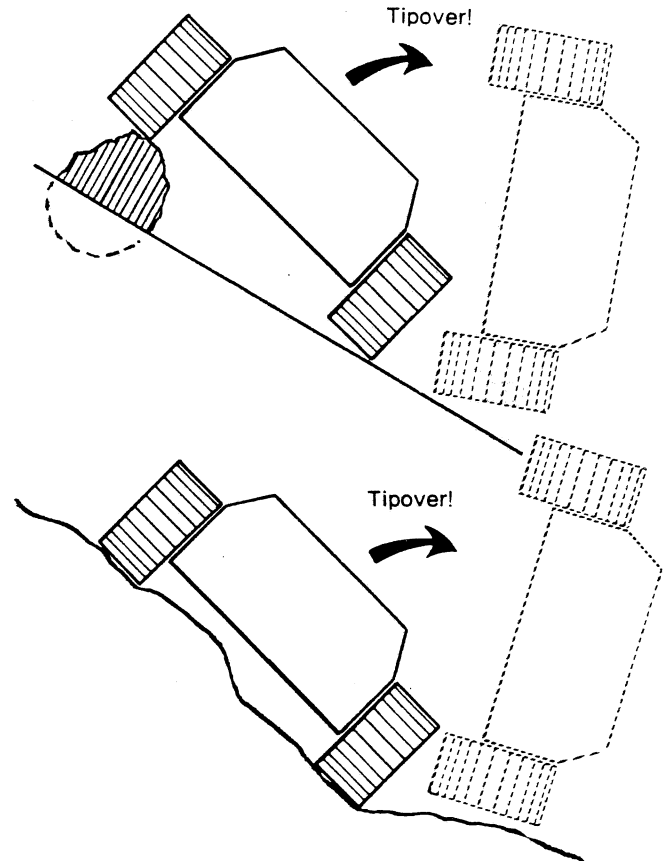
SIDEHILL OPERATION

The illustrations show how driving over an obstacle with the uphill track or into a hole with the downhill track will cause the vehicle to tip over sideways.

A slippery surface, like snow, ice, frozen sand, and loose gravel can also be dangerous. It is possible to slide into a tree or rock or to slide off the edge of a cliff.



SAFETY WARNING: REGARD ALL OPERATIONS ON SLOPING TERRAIN AS HAZARDOUS.



PARKING THE VEHICLE

When a Tracked Vehicle is parked on a sufficient slope, failure to engage the parking brake or failure of the parking brake to function properly can result in the vehicle rolling down the slope, out of control.

OPERATING SAFETY PRECAUTIONS

1. Keep hands and feet inside vehicle.
2. Never attempt to operate the vehicle from anywhere other than the driver's seat.
3. Avoid unnecessary quick stops.
4. Avoid quick turns.
5. Shut off engine and engage parking brake when leaving vehicle.
6. Park sideways on slopes.

LIMITED WARRANTY

For 90 days from purchase date, we will at our option replace or repair for the original purchaser, free of charge, any part or parts found upon examination at our factory to be defective under normal use and service on account of **defects in material and/or workmanship.**

All transportation charges on, and damages and loss incurred in connection with the transportation of parts for inspection for replacement or repair under this warranty shall be borne by purchaser.

The EXPRESS WARRANTY contained herein SHALL NOT APPLY to any Tractor, Attachment or part which shall have been altered in any way NOR SHALL SUCH EXPRESS WARRANTY APPLY to any damages resulting from accident, misuse or abuse, NOR SHALL SUCH EXPRESS WARRANTY APPLY to any damages resulting from failure to follow the C. F. Struck Corp.'s Instructions for operation and maintenance of Tractors, Attachments and parts. In addition the Express Warranty contained herein shall not apply to Engines, Transmission, Gear Boxes, etc. which are not of our manufacture as they are covered by the manufacturer's own warranty. In addition, we reserve the right to make design and specification changes on future machines without notice and without obligation on our part to present owners.

The foregoing EXPRESS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS WARRANTIES. C. F. Struck Corp. neither assumes nor authorizes any other person, natural or corporate, to assume for it any other obligation or liability in connection with or with respect to any Tractors, Attachments or parts.

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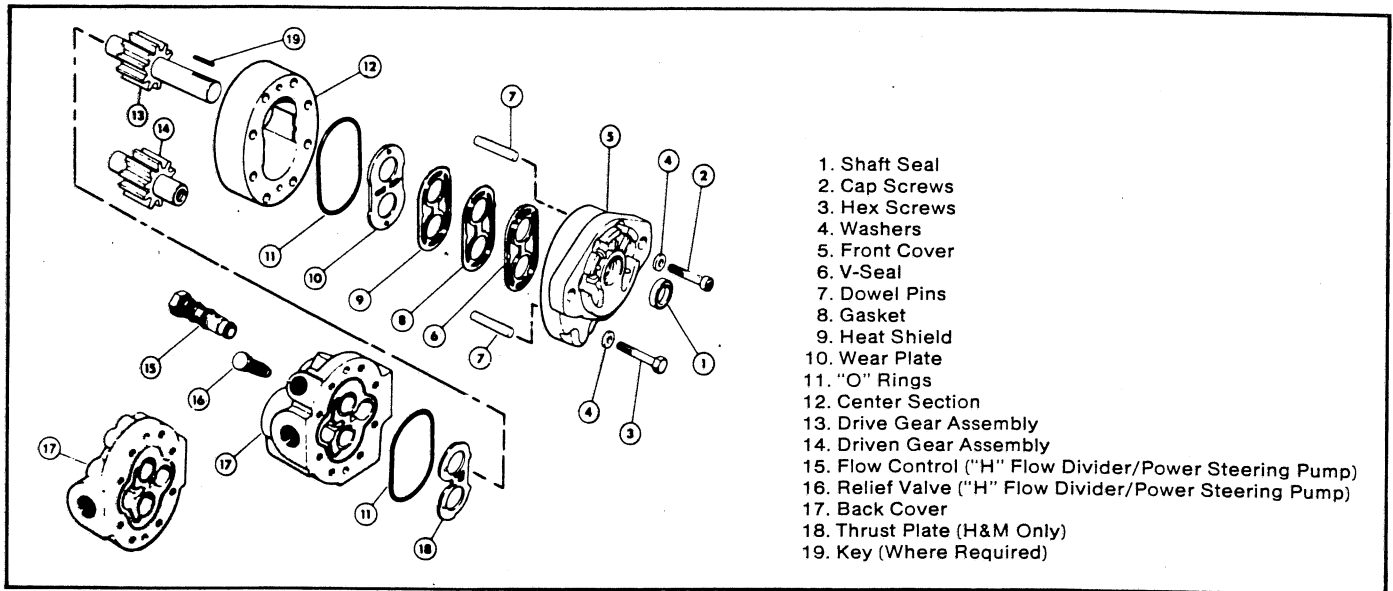


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December 88

Series D/H/M Fixed Displacement Gear Pumps Service Manual

Parker Hannifin Corporation
Fluidpower Pump Division
100 Parker Drive
Otsego, Michigan 49078
Phone: (616) 694-9411
FAX: (616) 694-4638

Series D/H/M Fixed Displacement Gear Pumps



Trouble Shooting Guide

Before the pump is removed or disassembled, check the following list of common troubles and remedies. It could save time effort, and money.

Trouble	Probable Cause	Remedy
1. Noisy Pump	a. Low oil supply b. Oil too heavy, (i.e. viscous) c. Air leak in inlet line d. Partly blocked inlet line	a. Fill reservoir b. Change to proper viscosity c. Check plumbing d. Check for foreign object and/or clean
2. Foaming Oil	a. Pump cavitating b. Water in the oil	a. See 1a, 1b, 1c, 1d b. Check reservoir and/or heat exchange
3. Pump or oil overheating	a. Oil supply too thin b. Oil supply contaminated c. Pump cavitating d. Pump drive shaft excessively misaligned with pump driven shaft e. Pump drive shaft axially loaded by driving shaft (Prime Mover) f. System relief valve bypassing	a. Drain and fill with proper viscosity oil b. Drain, clean filter, & fill with clean oil c. See 1a, 1b, 1c, 1d d. Check alignment e. Check for clearance at ends of shafts, for shaft misalignment or worn driving keys, keyways or splines. If pulley drive check for belt alignment. f. Check relief valve setting (see 4c)
4. Low Flow	a. Pump cavitating b. Foaming oil c. Relief valve leaks or set too low d. Speed too low e. Oil too hot	a. See 1a, 1b, 1c, 1d b. See 2a, 2b c. Check relief valve for foreign particles d. Check prime mover speed e. Check temperature (see 3a, 3b, 3c, 3d, & 3e)
5. Failure to build pressure	a. Defective relief valve b. Low oil supply	a. Check and reset or replace b. Fill reservoir

Repair Kits

Series	Part Number	Consisting of items
"D"	686632K 745083K (Viton Seals)	1, 6, 8, 9, 10, 11
"H"	706024K 745133K (Viton Seals)	1, 6, 8, 9, 10, 11, 18
"H" - Flow Divider	696173K	1, 6, 8, 9, 10, 11, 18 Seals only. For 15 & 16
"H" - Power Steering	805333K	1, 6, 8, 9, 10, 11, 18 Seals only. For 15 & 16
"M"	715567K 745088K (Viton Seals)	1, 6, 8, 9, 10, 11, 18

Disassembly Instructions

- Clean unit thoroughly with solvent, kerosene, or other non-corrosive cleaning fluid, which will not affect rubber components.
- Scribe a line across the three sections of the pump to act as a guide in reassembly.
- Remove the six hex screws (3), and two cap screws (2). Remove the key (19) from the drive shaft. (Four hex screws in "D" series.)
- Remove the front cover (5) by lightly tapping the flange with a soft metal hammer.
- The center section (12) will remain attached to either the front cover (5) or back cover (19). Place the drive gear (13) into the unseparated sections, and while holding the center section (12), tap lightly to separate. Be careful to avoid cocking on the dowel pins (7).
- Remove wear plate (10) and thrust plate (18).
- Mark the front cover island next to the pressure vent hole in the heat shield (9), gasket (8), and V-seal (6) to act as a guide in reassembly. The location of this vent hole determines pump rotation.
- Use a small diameter wire (a paper clip will do) to remove the phenolic heat shield (9), the paper compound gasket (8) and the rubber "V" seal (6). Discard these parts and replace when pump is reassembled.
- Remove both "O" rings (11) and discard. They also should be replaced.
- Do not remove shaft seal (1) in the front cover (5) unless it is damaged or leaking. If seal is to be replaced, use great care not to damage the seal recess or bearing. Heating the cover in an oven to 250° F will reduce the press fit.
- If flow control is defective replace as a cartridge.
- If relief valve is defective replace as complete relief valve unit.

Inspection

Drive (13) and Driven (14) Gear Assemblies

Inspect shafts for roughness in the bearing and sealing areas. Measure for wear. Minimum acceptable .4998" in "D", .7492" in "H" and .9365" in "M". 5J surface finish maximum.

Inspect keyway, keys or splines for damage or excessive wear.

Inspect the gear end faces, outside diameter and teeth for roughness and score marks. The O.D. of the "D" gears must be 1.2395" minimum, "H" gears must be 1.7140" minimum and the "M" gears 2.1047" minimum. For minimum gear widths see Table (1).

Be sure snap rings are secure; break any sharp edges on the sides of the gears.

Gears and shafts are available only as assemblies. One gear assembly may be replaced separately if the other is in good condition.

Table 1

"D" Series		"H" Series		"M" Series	
Size	Minimum Gear Width	Size	Minimum Gear Width	Size	Minimum Gear Width
D05	.1875"				
D07	.2770"	H25	.4531"		
D09	.3463"	H31	.5663"	M09	1.0756"
D11	.4309"	H39	.7079"	M11	1.3446"
D14	.5412"	H49	.8849"	M14	1.6807"
D17	.6655"	H62	1.1072"		
D22	.8597"	H77	1.3840"		
D27	1.0562"	H90	1.6740"		

Front Cover (5) and Back Cover (18) Assemblies

If any bearing bore diameter exceeds .5015" in the "D" Series, .7518" in the "H" Series, or .9394" in the "M" Series, the cover should be discarded. Bearings are not supplied separately.

Replace the shaft seal (1) only if it shows excessive wear or cracking.

Check all internal threads for damage.

Bearings must be below the cover faces and show no signs of contact with snap rings on gear shafts.

If bearings are scored, rough, or show signs of heat discoloration, the cover assemblies should be replaced.

Center Section (2)

Inspect the wall of gear bore diameters for excessive wear or score marks. The center section gear bores will show signs of wear on the inlet side of the pump. A wear ridge will develop at the end of the gear bore where the thrust plate is located. This wear ridge should not exceed 1/32".

Lightly tap the faces to remove any nicks or burrs. Do not break inside edges.

Wear Plate (10) and Thrust Plate (18)

Inspect bronze wear surfaces for excessive roughness or heat discoloration. If wear ridges exceed .0005", discard and replace.

General

The following parts should be replaced at every major overhaul; Wear Plate (10), Thrust Plate (18), Fiber Heat Shield (9), Paper Gasket (8), "V" Seal (6), and "O" Rings (11). The shaft seal (1) should be replaced only when necessary.

Reassembly Procedure

- All parts must be thoroughly cleaned prior to reassembly by dipping in solvent and brushing to remove all traces of contamination. Pump should be assembled in a dirt free area.
- Install shaft seal (1), if it was removed, in front cover with the spring loaded lip facing inward. Force seal into place, using a flat steel rod slightly smaller in diameter than the O.D. of the seal. This will permit the tool to enter the seal recess and bottom the rotary seal on the stop. (The front cover (5) must be backed up on a smooth, clean surface to prevent damaging its face.)
The load to force seal into place should be applied exactly in line with the housing seal bore to prevent bending the seal steel retainer, and/or scoring the seal housing bore.
- Install the "V" seal (6), the gasket (8), and heat shield (9) into the front cover cavity as follows:
The small vent hole through all of these parts shall be in line and positioned next to the scribe mark on the island previously made during disassembly. This position locates the vent holes on the outlet side of the pump.
The lips on the V seal shall face toward the cavity and be tucked into the groove with the aid of a dull tool to prevent damage to the rubber surface. A small screw driver can be used.
The gasket shall be pressed firmly toward the bottom of the cavity with the thumbs so as to insure all of its perimeters are completely within the groove to avoid interference with subsequent assembly. The heat shield shall be firmly pressed toward the bottom of the cavity with the thumbs to provide sufficient space for the wear plate.
- Install "O" Rings (11) into the groove provided in front cover face. Oil the "O" Ring and stretch it slightly, if necessary, so that it will remain in its groove.
- Install the wear plate (10) with the bronze surface against the gears and the small vent hole in line with the hole in the heat shield. Press the wear plate. The wear plate shall be sufficiently within the oval cavity so that it is axially retained.
- Install drive gear (13) and drive gear (14) assemblies into the front cover. Apply oil to the shaft at the drive end to prevent damage to the shaft seal caused by sharp edges on the drive shaft passing through the shaft seal. An oil coated shaft, rotated slowly, will usually cause no damage to the seal. Check to see that the shaft seal lip and spring is not pushed out by the shaft.
- Check wear plate to insure it is still seated into its oval cavity and install the center section (12) over the gears until it engages the wear plate. Center section must be positioned so that the previously scribed lines on the housing exteriors are in line with those scribed on the front cover. The small slot located midway between the bores should align with the small vent hole in wear plate. The face containing the slot shall be in contact with the wear plate.
Then, install dowel pins (7) and add a generous amount of clean oil into the gear cavities. Rotate gears to distribute the oil.
- Position the thrust plate (18) on top of the gears in the center section, with the bronze face toward the gears. The open side should be toward the inlet.
- Install "O" Ring (11) into its back cover face groove. Oil the "O" Ring, the cover face, and the bearings. Install the back cover so that the scribe marks are in line with the marks on the center section and front cover.
- The housing retaining screws shall be alternately tightened to 190-210 in. lbs. on the "D" Series, 190-210 in. lbs. on the "H" Series and 355-375 in. lbs. on the "M" Series.
Add a generous amount of clean oil into both ports to insure the pump is adequately lubricated. Rotate the drive shaft to distribute the oil and check for freedom of shaft rotation. Shaft shall be free to rotate with the help of a short wrench. (100 in. lbs. maximum)

Testing Procedure

After pump has been re-installed run for 2-3 minutes before pressurizing. Try to apply pressure gradually for an additional five minutes, but do not pressurize for longer than 5 seconds at a time.



WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

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110 Series

Service and Parts List

High Torque, Low Speed Hydraulic Motor with Thru-Shaft Option

The 110 Series High Torque Low Speed (HTLS) hydraulic orbit motors are designed to provide long life while operating with limited radial load. Refer to catalog radial load limits. However, should maintenance be required, the instructions below should be used for disassembly, replacement of parts, cleaning and assembly.

Note: Prior to any motor disassembly, plug the open ports and clean all dirt from the outside of the motor. Prior to assembly lightly oil all seals, the rollers and the threaded bolt ends.

Part I—Installation Requirements

1. The motor may be mounted in any secure position.
2. If the system minimum downstream pressure exceeds 1000 psi on a continuous basis, the external case drain (9) should be vented to a low pressure area.
3. The standard motor seals are suitable for use with petroleum base oils. Consult the factory for use with other fluids.
4. A minimum of 25 micron filtration with B ratio of 2 is recommended.
5. For maximum system pressure refer to catalog.
6. Shaft may not turn freely after assembly. A short running break in period may be required.

Part II—Motor Disassembly

A. Disassembly of Cover Section of Motor

1. Remove the key (11) from the shaft if there is a key.
2. Mount the motor in a vise or other holding device with the shaft facing down.
3. Remove the eight 5/16-24 bolts (10). If motor has bolt washers, remove and discard them.
4. Remove the cover/bearing assembly (17) or (18) and the square ring (8).
5. Remove the IGR set components (6) starting with the outer locating ring and rollers. Note that the innermost IGR component and rotary valve (4) are retained on the shaft by the snap ring (7). Do **not** remove this snap ring.
6. Remove the two check valve balls (5). Note that the check balls may fall into the body tapped holes or into the body valve ports during disassembly. Be sure that the check balls are removed.
7. Remove the shaft (12) or (13), the IGR inner element, and the rotary valve (4) as one assembly.
8. With the shaft assembly removed from the body, inspect the IGR inner component, the rotary valve (4), and the shaft (12) or (13) for wear or other damage. The shaft should have smooth polished surfaces in the bearing and seal areas. If any of these components are damaged, the snap ring (7) must be removed and the appropriate components replaced. If the snap ring (7) is removed, **discard** it.
9. Check IGR tip clearance. Replace the IGR assembly if the clearance between the inner-most rolls and outer contour exceeds .010 inches.

B. Main Shaft Seal Replacement

1. If the motor body shaft seal has shown signs of leakage during operation, the quad ring seal (3) and back-up ring (2) must be replaced with the motor completely disassembled per Part II, Section A above.
2. The quad ring seal (3) and the back-up ring (2) can be removed using a dull pointed object such as a pencil point or the end of a paperclip. Do **not** use a sharp object such as a knife because the sealing surface in the body or cover can be damaged.
3. With the old quad ring seal and back-up ring removed, install a new back-up ring first and push it against the sealing surface toward the outside of the motor. The back-up ring can be seated with a dull object.
4. Next install the new quad ring seal on the inboard side of the back-up ring and push it against the back-up ring.
5. Lubricate the inside diameter of the quad ring and back-up ring with oil.

C. Thru Cover Shaft Seal Replacement

1. If the motor body thru cover shaft seal has shown signs of leakage during operation, the seals must be replaced with the motor completely disassembled per Part II, Section A above.
2. The lip seal (19) can be removed using a dull pointed object such as a pencil point or the end of a paperclip. Do **not** use a sharp object such as a knife because the sealing surface in the cover can be damaged. **Note:** models pre-January 1, 1986, Serial Number A6 and earlier, contain quad rings and back-up rings.



3. With the old seal removed, install the new lip seal into the bore with the rubber lips facing the inboard side (the flat seal back against the bore floor). **Note:** models pre-January 1986, Serial Number A6 and earlier, require quad rings and back-up rings as the replacement seals (see Note 3, page 3). Install the back-up ring into the cover bore and push it against the sealing surface toward the outside of the motor. Put the quad ring in next on the inboard side of the back-up ring and push it against the back-up ring.
4. Press the dust seal into the bore on the outboard side of the cover. Make sure that the rubber lips are facing the outside of the motor. The dust seal's back should be flush with the bottom of the bore.
5. Lubricate the inside diameter of the seals with oil.

Part III—Motor Assembly

A. Shaft, IGR Inner, and Rotary Valve Assembly

1. If the shaft assembly has been disassembled intact according to Part II, Section A, step 7; proceed to Part III, Section B.
2. Place the rotary valve (4) on the shaft spline with the "T" shaped slots on first.
3. Next put the IGR inner member on the shaft spline with the semi-circular roll pockets between the rotary valve ports.
4. Now install the new snap ring (7) which holds the inner and valve on the shaft. Be sure not to over-extend the snap ring during assembly. The snap ring should be snug in the groove when finally assembled.

B. Assembly of Complete Motor

1. Prior to assembly, all parts must be cleaned with a suitable solvent and be free of nicks and burrs.
2. Mount the body with the pilot and bearing down in a vise or other holding mechanism.

3. Check the output shaft end for burrs and scratches, especially on a used keyed shaft. De-burr if necessary. The shaft end must be free of burrs because it slides through the quad ring and can cut it. Install the shaft assembly into the body.
4. Place the contour member of the IGR over the inner and insert the seven rolls into the inner pockets (larger in diameter than the eight rollers).
5. Lightly oil the square ring seal (8) and place in the body groove.
6. Place the check balls (5) over the two 1/8 inch diameter holes in the body. Be sure the check balls do not fall into the tapped holes.
7. Place the locating ring section (4.5 inch diameter) of the IGR (6) onto the body with the check ball holes facing downward over the balls. Align the eight bolt holes in the locating ring with the eight holes in the body. The holes align in only one position.

Note: Be sure not to dislodge the body square ring seal while moving the locating ring.

8. Install the eight locating ring rollers into their pockets and oil lightly.
9. Place the other lightly oiled square ring seal (8) into the groove in the cover and place the cover over the shaft end and align the bolt holes.
10. If the motor had bolt washers, install the bolts with new washers, Part #1047. Install the eight bolts with lightly oiled thread ends into the bolt holes. Tighten diagonally to 15 lbs. ft. Turn the shaft by hand through several rotations. Increase the torque of each bolt by 5 lbs. ft. in a diagonal pattern. Turn the shaft by hand through several rotations. Repeat this procedure until the torque of each bolt has reached 27 lbs. ft.

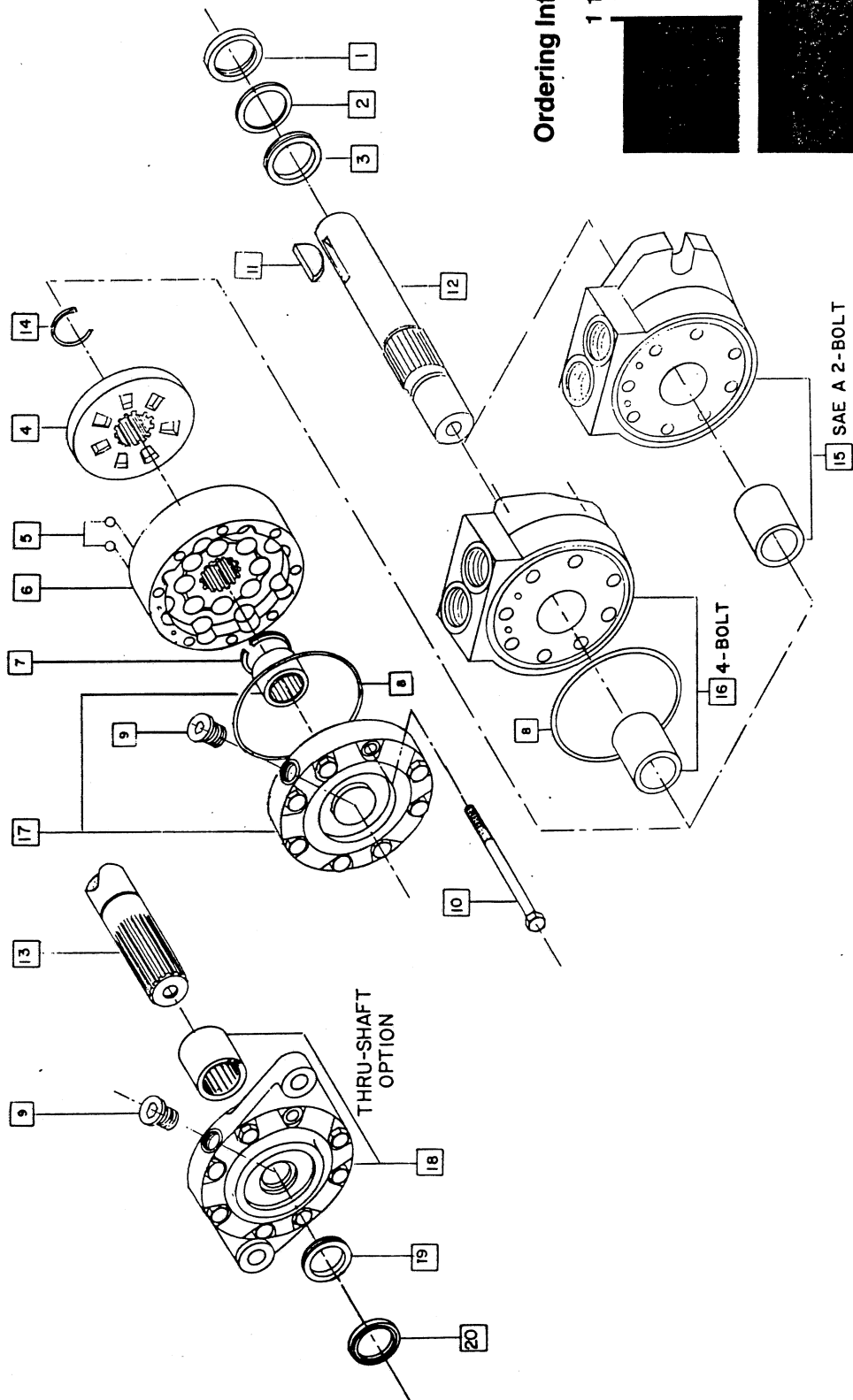


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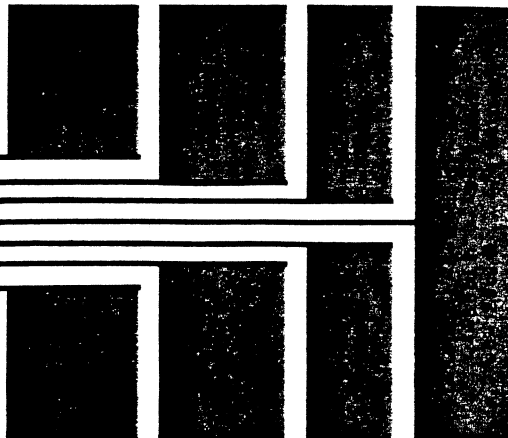
Phone: (207) 657-3343

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Ordering Information

110-7-AS-O



Item	Part No.	Part Description	Model No.	Quantity Per Motor
1	1061	Dust Seal 1.0	All Models	1
2	1142-14	Back Up Ring 1.0		1
3	1062-15	Quad Ring Seal 1.0		1
4	1007	Rotary Valve 7110		1
5	1021	Check Valve Ball .25		2
6	1004-1	IGR Assembly W/Ring 7110-3.6 cu. in./rev.		1
	1004-2	IGR Assembly W/Ring 7110-5.4 cu. in./rev.		1
	1004-3	IGR Assembly W/Ring 7110-7.1 cu. in./rev.		1
	1004-4	IGR Assembly W/Ring 7110-8.8 cu. in./rev.		1
	1004-5	IGR Assembly W/Ring 7110-10.6 cu. in./rev.		1
	1004-6	IGR Assembly W/Ring 7110-12.9 cu. in./rev.		1
	1004-7	IGR Assembly W/Ring 7110-16.4 cu. in./rev.		1
7	1135	Snap Ring Shaft		1
	1296	Snap Ring Shaft*		1
8	1046	Square Ring Seal 046		2
9	1019-4	Vent Plug W/O-Ring, 7/16		1
10	1114-X	Bolts, Hex 5/16-24, Displacements 1-5		8
	1014-2	Bolts, Hex 5/16-24, Displacement 6		
	1014-4	Bolts, Hex 5/16-24, Displacement 7		
11	1655	Key, Woodruff, .25x1.00	110-X-XX-X	1
12	1110-X	Shaft, Key Straight	110-X-XX-0	1
	1115-X	Shaft SAE 6B	111-X-XX-0	1
	1113-X	Shaft 13T Spline	116-X-XX-0	1
	1682-X	Shaft, Key Woodruff	110-X-XX-0	1

Item	Part No.	Part Description	Model No.	Quantity Per Motor
13	1152-X	Shaft SAE 6B Thru	111-X-XX-1	1
	1151-X	Shaft 13T Spline Thru	116-X-XX-1	1
	1758	Shaft, Key Woodruff Thru	110-X-XX-1	1
14	1157	Snap Ring Valve (For Thru Shaft Only)	11X-X-XX-1	1
15 ²	M110B-1	Body/Bearing Assembly SAE 2 Bolt	11X-X-AS-X	1
	M110B-3	Body/Bearing Assembly SAE A 2 Bolt-Manifold	11X-X-AM-X	1
	M110B-5	Body/Bearing Assembly SAE A 2 Bolt-Pipe	11X-X-AP-X	1
	M110B-7	Body/Bearing Assembly SAE B 2 Bolt	11X-X-BS-X	1
	M110B-9	Body/Bearing Assembly SAE B 2 Bolt-Manifold	11X-X-BM-X	1
	M110B-10	Body/Bearing Assembly SAE B 2 Bolt-Pipe	11X-X-BP-X	1
16 ²	M110B-2	Body/Bearing Assembly 4 Bolt	11X-X-FS-X	1
	M110B-4	Body/Bearing Assembly 4 Bolt-Manifold	11X-X-FM-X	1
	M110B-6	Body/Bearing Assembly 4 Bolt-Pipe	11X-X-FP-X	1
17 ²	M110C-1	Cover/Bearing Assembly	XXX-X-XX-0	1
18 ²	M110C-2	Cover/Bearing Assembly Thru	XXX-X-XX-1	1
19 ³	1391	Lip Seal .875	XXX-X-XX-1	1
20	1141	Dust Seal .875		1
—	1158	Body Seal Kit	All Models	1
	1386	Body Seal Kit, Viton		1
—	1166	Cover Seal Kit (Thru)	Thru Shafts	1
	1387	Cover Seal Kit (Thru), Viton		1

NOTES:

- ¹"X" in the Part No. refers to the displacement dash number which follows the Model Number on the nameplate. (i.e., 100-1-AS-0-X-1). The displacements are shown above under item #6.
- ²Body Assemblies (Items #15 and #16) and Cover Assemblies (Items #17 and #18) include respective bearings and seal components.
- ³Models pre-January 1, 1986 (S/N A6 and earlier) require quad ring P/N 1062-13 and back up ring P/N 1142-12 as replacements.
- ⁴Date codes Feb. '87 and later.

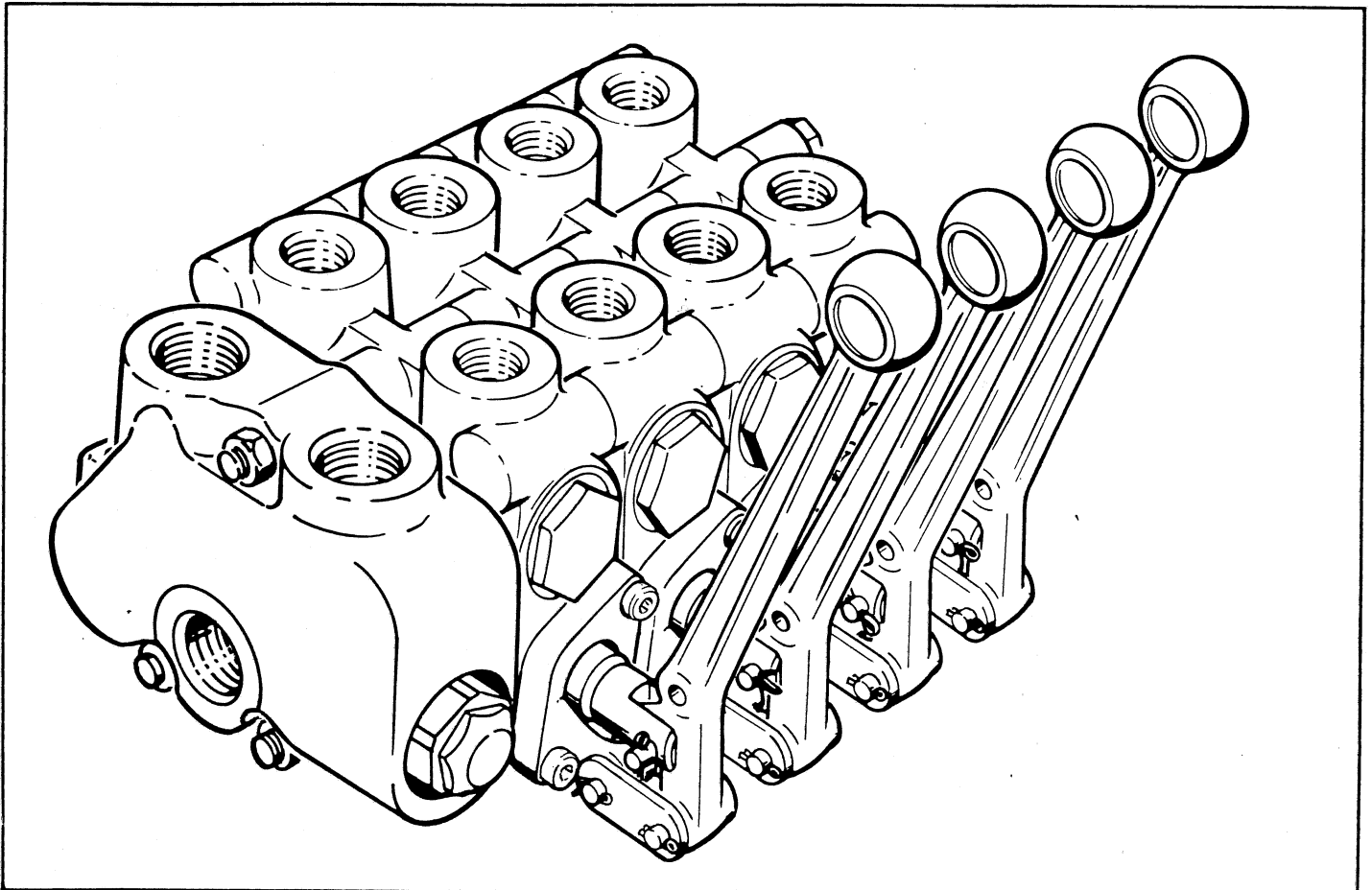
GRESEN[®]



**HYDRAULIC
COMPONENTS**

**MODEL V20
SECTIONAL BODY
DIRECTIONAL CONTROL VALVE**

SERVICE and PARTS MANUAL



MOBILE INDUSTRIAL AGRICULTURAL

SECTION III MAINTENANCE

REPLACING, ADDING OR REMOVING SECTION ASSEMBLIES

4. If valve sections are to be added or removed, use the proper length assembly studs from the chart below.

NOTE

For clarification, we shall call the inlet cover containing the main relief the left side of the valve assembly. Refer to Figure 3-1.

1. Before disassembly, it is suggested that each valve section be marked numerically to avoid incorrect reassembly.
2. Remove three assembly stud nuts (Item 32, Figure 4-1) from the left end section using a 9/16" thin wall socket.
3. Remove valve sections by sliding from assembly studs (Item 1, Figure 4-1).

No. of Sections	Assembly Stud Kit No.*
1	K-6104-D
2	K-6105-D
3	K-6106-D
4	K-6107-D
5	K-6108-C
6	K-6109-C
7	K-6110-C
8	K-6111-C
9	K-6112-C

*Each Kit contains 3 assembly studs and 3 9310-006 hex nuts.

NOTE: When using 8644 Right End Cover, add one section to assure proper stud length.

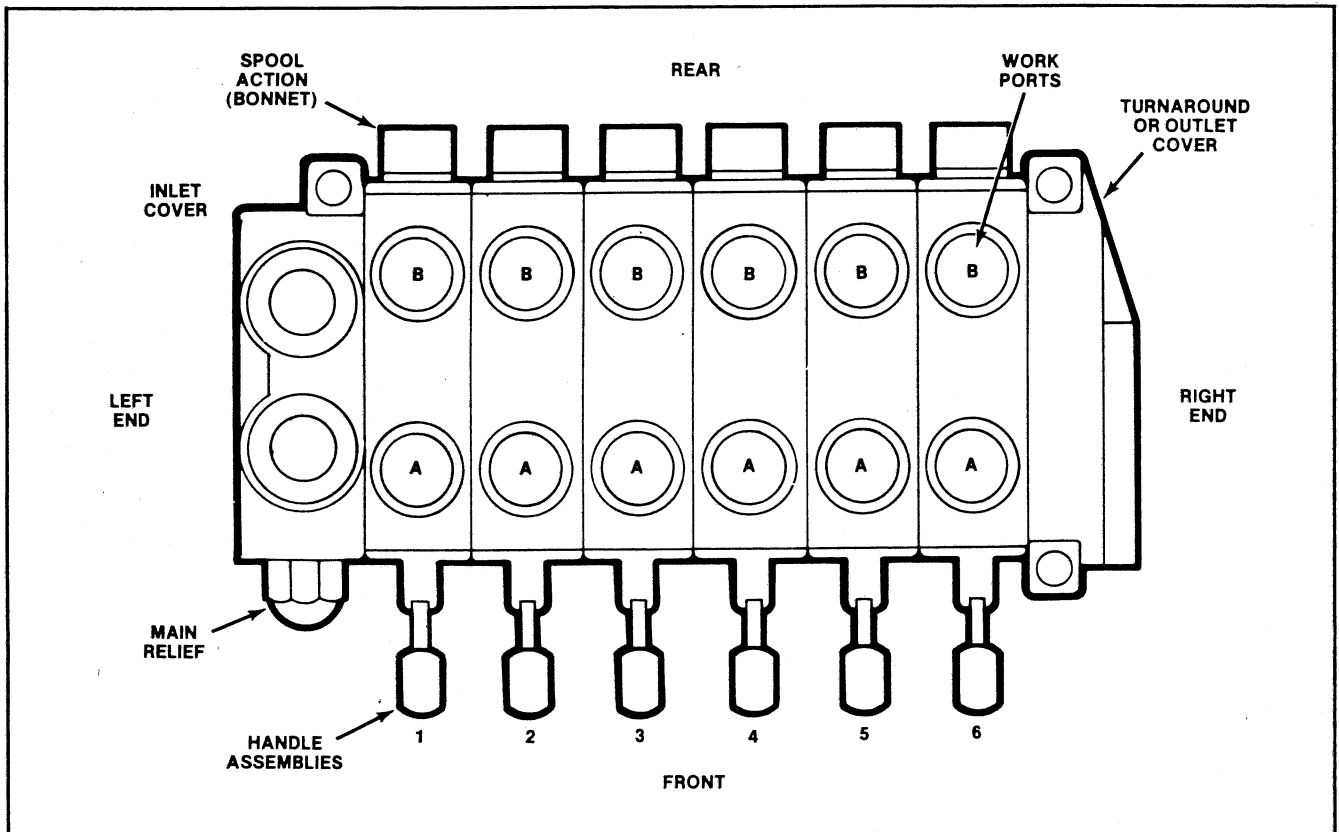


Figure 3-1. Schematic-View of Typical Control Valve Assembly.

NOTE

Use assembly nuts (part no.9310-006), 3 required, with all assembly studs. **NO LOCK WASHERS!** All studs are stress-proof material and should be replaced only with original equipment replacement parts.

5. Thoroughly clean O-ring counterbores and ground surfaces of each section.
6. Replace the four O-rings. Use two 6815-002 and two 6814-002 seals per section. Buna-N seals are standard. For optional Viton seals, see cross reference chart on page 4-36.
7. Replace valve sections on assembly studs in the same order in which they were removed. O-ring counterbores should be to the left when facing "A" port-end of valve.

NOTE

Use care in replacing valve sections to avoid dislodging O-rings from counterbores.

8. When all valve sections are positioned on assembly studs, replace stud nuts and tighten evenly to 32 ft. lbs. [43 Nm] torque.

CAUTION

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

REPLACING SPOOL SEALS

Valve sections and covers are identified by numbers cast into the body. Refer to Table 2-1, page 2-0.

Figure 3-2 shows spool assembly—less the complete handle assembly. When handle bracket is furnished, retainer plates and screws (items 1 and 4, Figure 3-2) are omitted. Seal assembly is retained by the handle bracket which will also retain the optional wiper seal.

1. Remove bonnet assembly parts from back of valves and keep in order of disassembly.

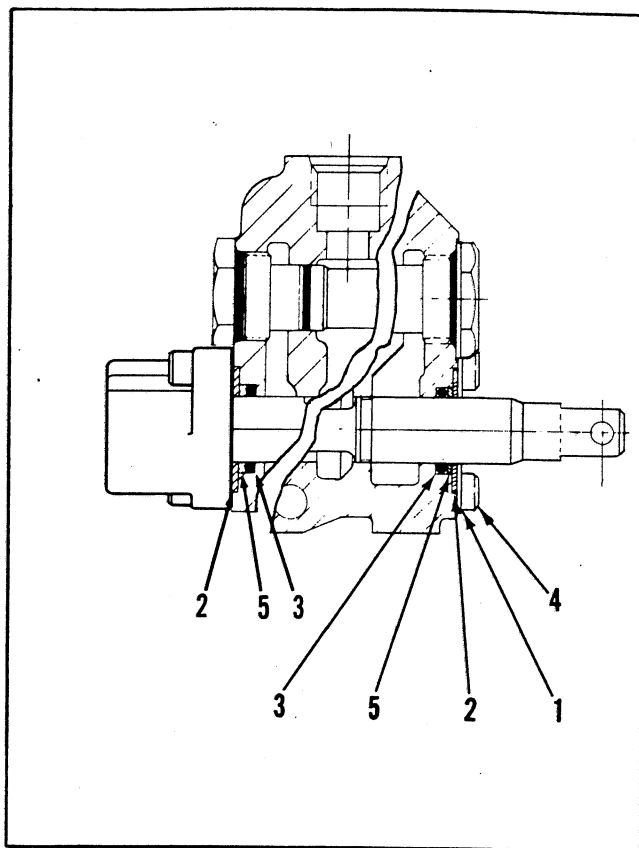


Figure 3-2. Spool Seal Assembly -

2. Remove all parts connected to the spool on the front of the valve, either the complete handle bracket assembly, or the seal retainer assembly if a handle bracket is not furnished.

NOTE

DO NOT REMOVE the spool as the seals can be replaced externally. Prevent spool from turning or moving by inserting a screw driver through clevis slot, or running a rod through the pin hole and using as a handle. **DO NOT** hold the spool with a wrench. This will destroy the finish.

3. Remove retainer plate (Item 1, Figure 3-2), retainer plate washers (Item 2), back-up washers (Item 5), and spool seals (Item 3).
4. Thoroughly clean counterbore.
5. Lightly oil new seals. Slide over valve spool and insert in seal counterbore.

SECTION IV PARTS LISTING

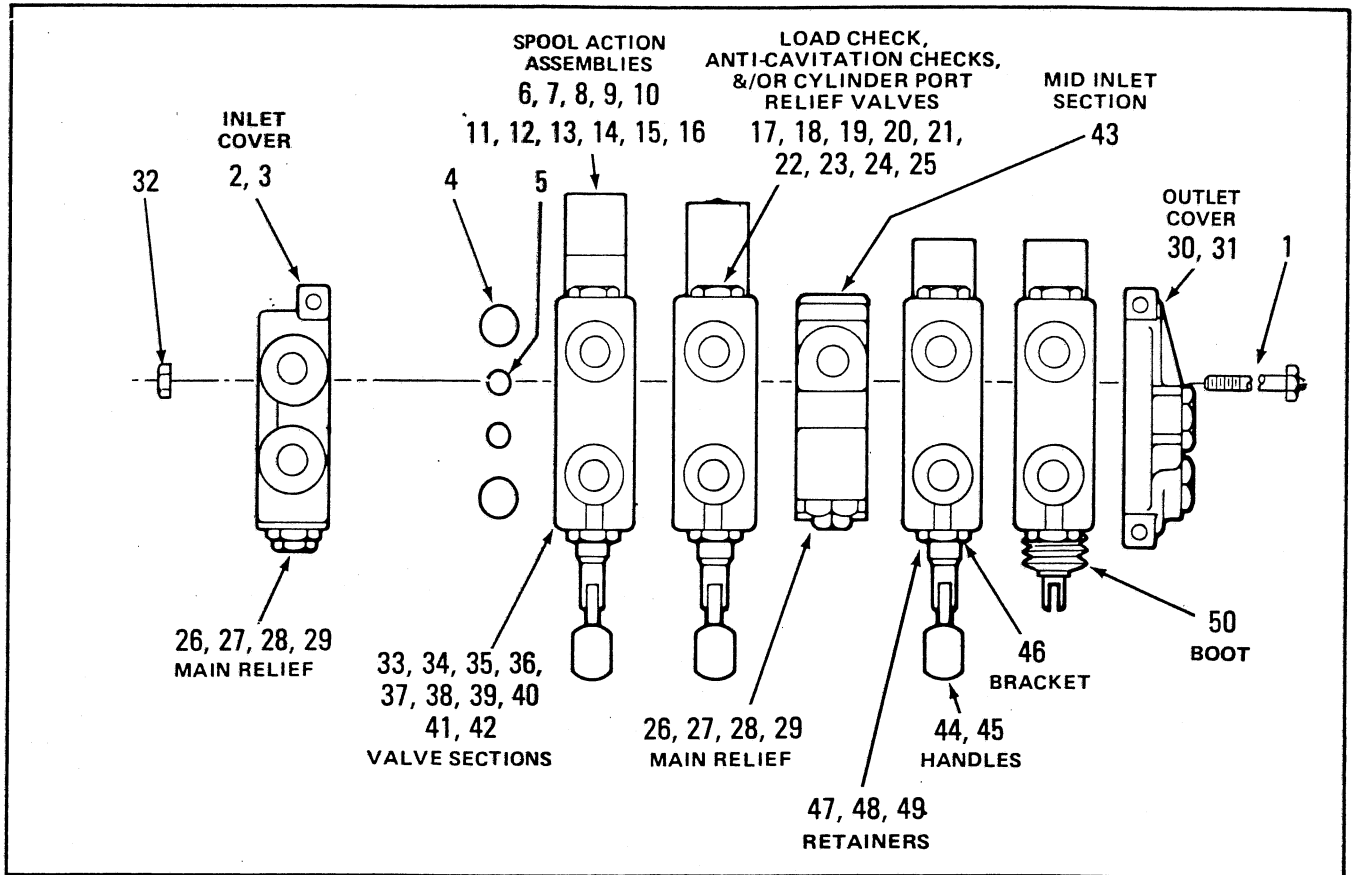


Figure 4-1. Model V20 Directional Control Valve, Typical Main Assembly.

MODEL V20 DIRECTIONAL CONTROL VALVE, TYPICAL MAIN ASSEMBLY

Item No.	Part No.	Description	Quantity Per Assembly
1	K-6104-D	STUD KIT, 1-Section	1
	K-6105-D	STUD KIT, 2-Section	
	K-6106-D	STUD KIT, 3-Section	
	K-6107-D	STUD KIT, 4-Section	
	K-6108-C	STUD KIT, 5-Section	
	K-6109-C	STUD KIT, 6-Section	
	K-6110-C	STUD KIT, 7-Section	
	K-6111-C	STUD KIT, 8-Section	
	K-6112-C	STUD KIT, 9-Section	
2	8398-	COVER, Left (Refer to Page 3-3)	1
3	7736-	COVER, Left, with flow control (Refer to Page 3-3 and Figure 4-42)	1
4	6815-002*	O-RING, Exhaust, Large	2 plus
			2 per section

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-36.

MODEL V20 DIRECTIONAL CONTROL VALVE, TYPICAL MAIN ASSEMBLY (Continued)

Item No.	Part No.	Description	Quantity Per Assembly
5	6814-002*	O-RING, Pressure, Small	2 plus 2 per section
6		POSITIONER, Standard Spool (See Figure 4-12)	A/R
7		POSITIONER, Manual Spool (See Figure 4-13)	A/R
8		POSITIONER, Float Detent, 4-Way, 4-Position (See Figure 4-14)	A/R
9		DETENT, Option "R", With Spring Return To Neutral (See Figure 4-15)	A/R
10		DETENT, Option "D", 3-Position (See Figure 4-16)	A/R
11		SPRING EXTENDED SPOOL, Option "A" (See Figure 4-17)	A/R
12		ELECTRO-MAGNETIC SPOOL RELEASE (See Figure 4-18)	A/R
13		POSITIONER, Pressure Detent Release (See Figure 4-19)	A/R
14		POSITIONER, Rotary, Option "W" (See Figure 4-20)	A/R
15		POSITIONER, Standard Spool, V20S or V20R (See Figure 4-21)	A/R
16		POSITIONER, Float Detent, 4-Way, 4-Position, V20S (See Figure 4-22)	A/R
17		CHECK, Lockout (See Figure 4-30)	A/R
18		CHECK, Anti-Cavitation (See Figure 4-31)	A/R
19		CHECK, Anti-Cavitation, V20S (See Figure 4-32)	A/R
20		PLUG, Load Check, (See Figure 4-33)	A/R
21		PLUG, Load Check, V20S (See Figure 4-34)	A/R
22		RELIEF, Work Port, Model RC (See Figure 4-35)	A/R
23		RELIEF, Work Port, Model RCA (See Figure 4-36)	A/R
24		RELIEF/ANTI-CAVITATION CHECK, Work Port, Model CRA (See Figure 4-37)	A/R
25		RELIEF, Work Port, Model RCS (See Figure 4-38)	A/R
26		RELIEF, Main, Model WH (See Figure 4-39)	A/R
27		RELIEF, Main, Model WHA (See Figure 4-40)	A/R
28		RELIEF, Main, Model RP51 (See Figure 4-41)	A/R
29		PLUG, No Main Relief (NR) (See Figure 4-43)	A/R
30	6770-	COVER, Right (See page 3-5)	1
31	8644-	COVER, Right (See page 3-5)	1
32	9310-006	NUT, Stud (Not sold separately. See Item No. 1)	
33	8072-	VALVE SECTION, 4-Way, 4-Position, Float (See Figure 4-2)	A/R
34	8072-	VALVE SECTION, 4-Way, 3-Position (See Figure 4-3)	A/R
35	8072-	VALVE SECTION, 3-Way, 3-Position (See Figure 4-4)	A/R
36	8072-	VALVE SECTION, 4-Way, 3-Position, With Pressure Detent Release (See Figure 4-5)	A/R
37	11571-	VALVE SECTION, 4-Way, 3-Position, With Pilot Operated Checks (See Figure 4-6)	A/R
38	8112-	VALVE SECTION, Tandem (See Figure 4-7)	A/R
39	10954-	VALVE SECTION, Low Pressure Drop (See Figure 4-8)	A/R
40	10762-	VALVE SECTION, Tandem, Low Pressure Drop (See Figure 4-9)	A/R
41	11483-	VALVE SECTION, Series (See Figure 4-10)	A/R
42	11483-	VALVE SECTION, Series, 4-Way, 4-Position, Float (See Figure 4-11)	A/R
43	6825-001	MID-INLET SECTION, Split Flow, Top Inlet 3/4—14 NPT	A/R
	6825-004	MID-INLET SECTION, Split Flow, Top Inlet 1/2—14 NPT	A/R
	6825-007	MID-INLET SECTION, Split Flow, Top Inlet SAE 12 (1-1/16—12 UNF)	A/R
	6825-011	MID-INLET SECTION, Split Flow, Top Inlet SAE 10 (7/8—14 UNF)	A/R
	6825-005	MID-INLET SECTION, Combined Flow, Top Inlet 3/4—14 NPT	A/R
	6825-008	MID-INLET SECTION, Combined Flow, Top Inlet 1/2—14 NPT	A/R
	6825-013	MID-INLET SECTION, Combined Flow, Top Inlet SAE 10 (7/8—14 UNF)	A/R
	6825-016	MID-INLET SECTION, Combined Flow, Top Inlet SAE 12 (1-1/16—12 UNF)	A/R
	6825-002	MID-INLET SECTION, Top Cored Hole Plugged with 3/8—18 NPT Plug	A/R
44		HANDLE ASSEMBLY, Vertical (See Figure 4-27)	A/R
45		HANDLE ASSEMBLY, Horizontal (See Figure 4-28)	A/R
46		BRACKET, Standard Handle (See Figure 4-26)	A/R
47	K-6033-B	RETAINER, Seal, Standard (See Figure 4-23)	A/R
48	K-6029-B	RETAINER, Seal, Heavy Duty (See Figure 4-24)	A/R
49	K-6057-A	RETAINER, Seal, Extra Heavy Duty (See Figure 4-25)	A/R
50	K-6056-B	BOOT ASSEMBLY, Spool Protective (See Figure 4-29)	A/R

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-36.

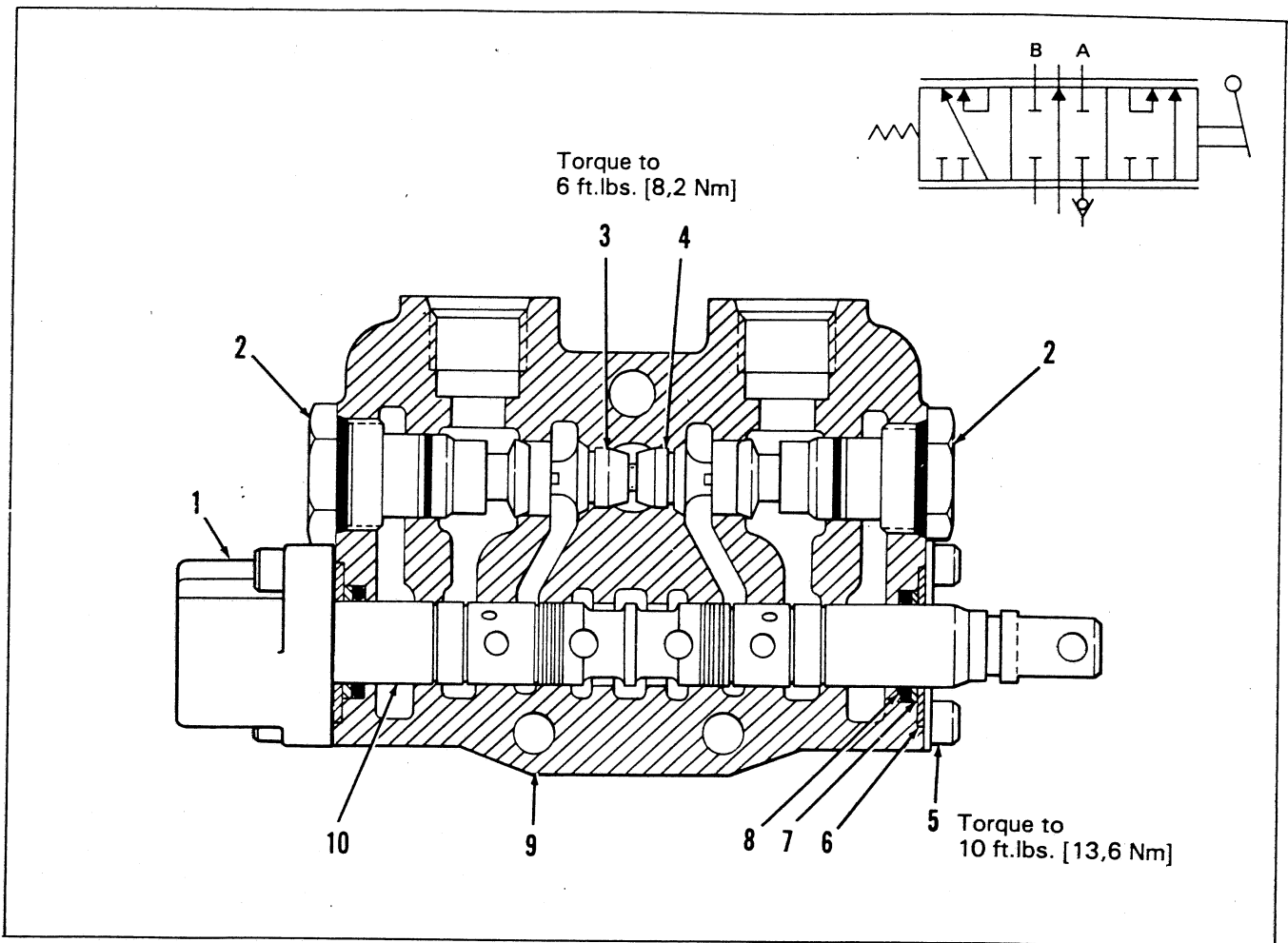


Figure 4-10. 4-Way, 3-Position, Series Valve Section.

4-WAY, 3-POSITION, SERIES VALVE SECTION

Item No.	Part No.	Description	Quantity Per Section
1	K-6207-A	POSITIONER, Spool, Standard (See Figure 4-21)	1
2	K-6203	CHECK, Load (See Figure 4-34)	2
3	11246-001	PLUG, Power Core } See Note 1	1
4	11716-001		
5	K-6033-B	RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-29 for optional assemblies.)	1
6	6752-001	RETAINER, Plate Washer	2
7	3265-001	WASHER, Back-Up	2
8	7700-001*	Seal, O-Ring	2
9	11483-	HOUSING, V20 Series } See Note 2	1
10	11245-001		

NOTES:

1. Parts not sold separately. Order K-6200-A. Power core plug assembly is only used in Series housings manufactured prior to May 1, 1985 (Series housing #8072).

2. These are matched parts and are not sold separately. Refer to Ordering Instructions, Page 3-7 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-36.

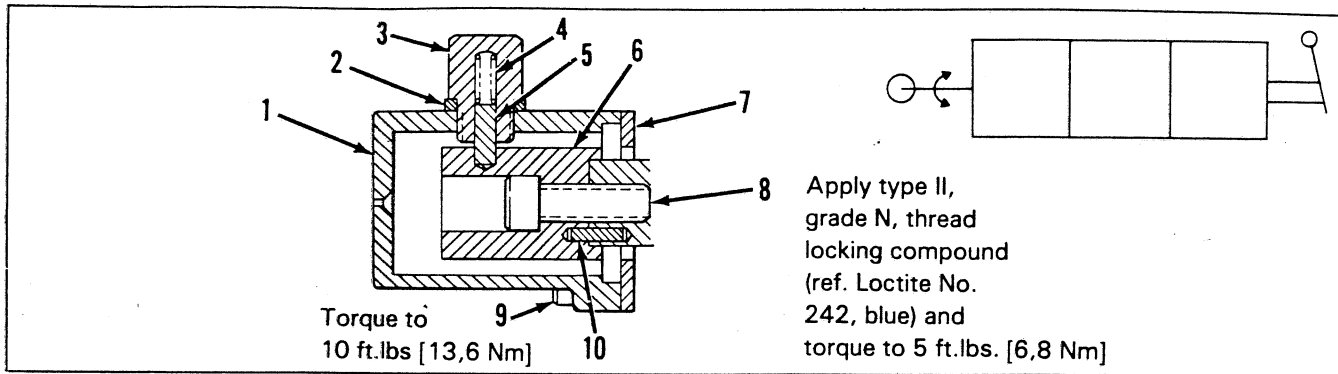


Figure 4-20. Option "W" Rotary Spool Positioner.

OPTION "W" ROTARY SPOOL POSITIONER

Item No.	Part No.	Description	Quantity
	K-6141-C	REPLACEMENT KIT (Contains all items listed below)	
1	1824-006	BONNET, Rotary	1
2	8743-001	WASHER, Detent Cap	1
3	8744-001	CAP, Rotary Detent	1
4	8808-001	SPRING, Detent	1
5	2676-001	PIN, Detent	1
6	8746-001	BODY, Rotary Cam	1
7	6552-001	PLATE, Seal Retainer	1
8	3731-150	SCREW, HSHC, 5/16-18 by 1 inch long	1
9	9161-407	SCREW, HSHC, 1/4-20 by 7/8 inch long	2
10	0888-001	PIN, Dowel	1

NOTE: Apply heavy duty, general purpose grease to the helical groove of Cam Body (Item 6) and Pin (Item 5). For standard assembly, hole in spool clevis must be horizontal with valve spool in neutral.

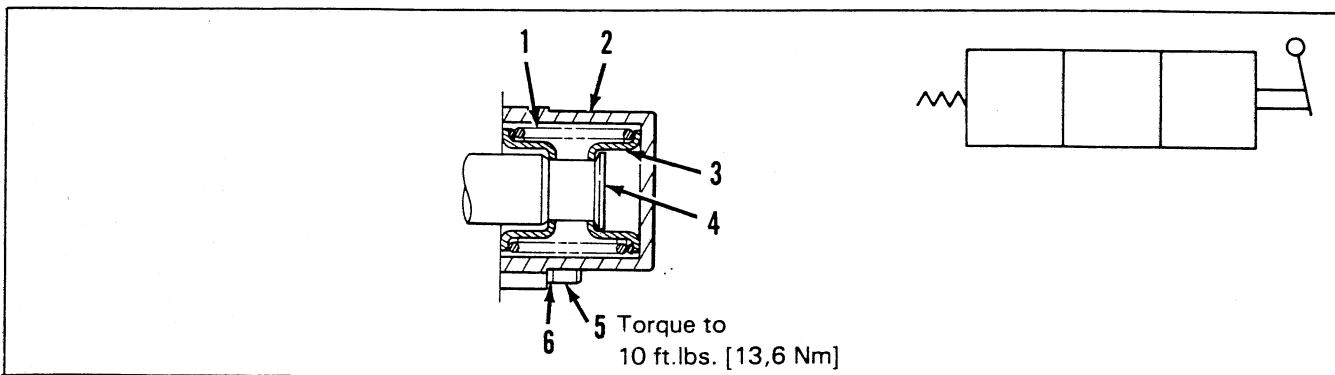


Figure 4-21. Series or Low Pressure Drop, Standard Spool Positioner.

SERIES OR LOW PRESSURE DROP, STANDARD SPOOL POSITIONER

Item No.	Part No.	Description	Quantity
	K-6207-A	REPLACEMENT KIT (Contains all items listed below)	
1	10956-001	SPRING, Return	1
2	1811-001	BONNET	1
3	1809-001	COLLAR, Spring	2
4	10892-001	COLLAR, Spool	1
5	3731-101	SCREW, HSHC, 1/4-20 x 7/8 inch long	2
6	0563-001	WASHER, Lock	2

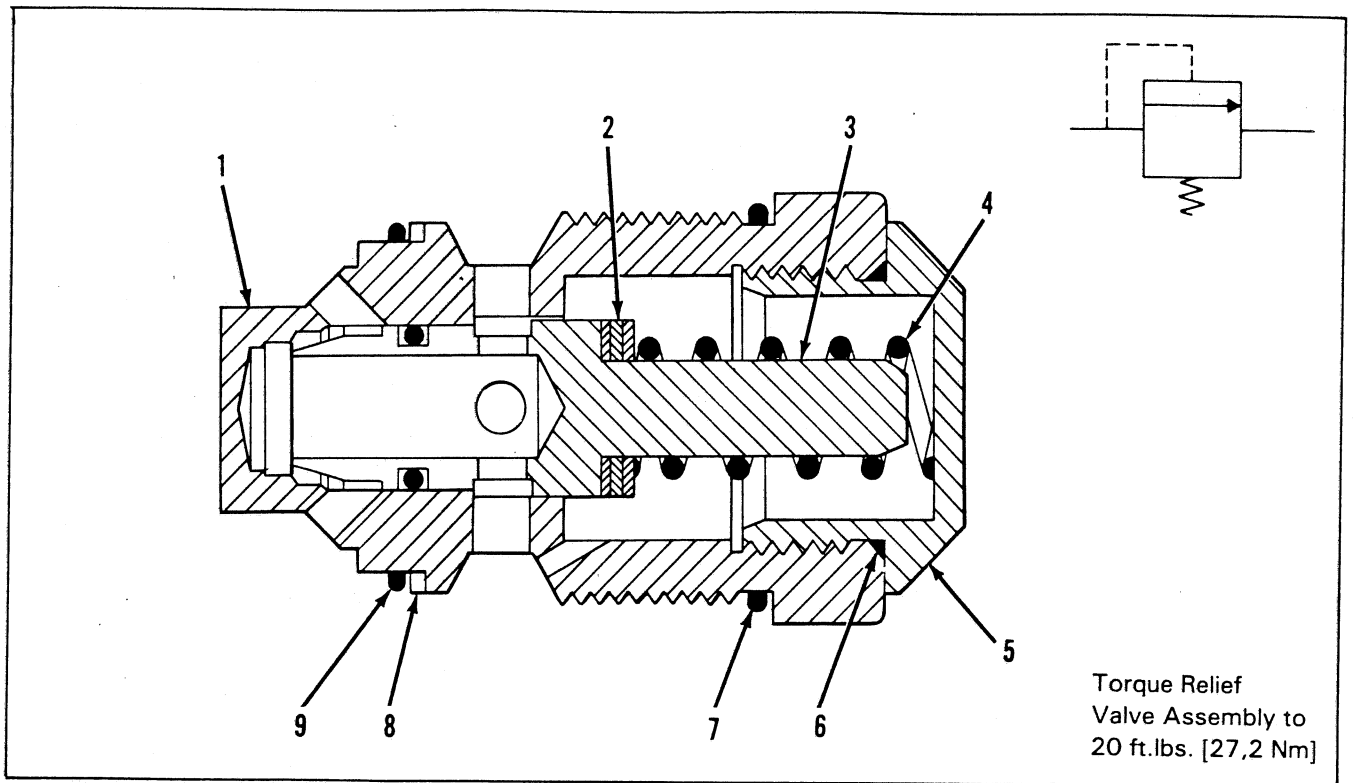


Figure 4-39. Model WH Differential Poppet Main Relief Valve (Non-Adjustable).

MODEL WH DIFFERENTIAL POPPET MAIN RELIEF VALVE (Non-Adjustable)

Item No.	Part No.	Description	Quantity Per Relief
	K-19003-A*	SEAL KIT (Contains items 6 thru 9)	
1	6533-001	BODY, WH Relief	1
2	0458-001	SHIM (.040 inch [1,0 mm] thick)	A/R
	0459-001	SHIM (.020 inch [0,5 mm] thick)	A/R
	0462-001	SHIM (.010 inch [0,25 mm] thick)	A/R
	3936-001	POPPET	1
4	1450-001	SPRING, Standard, 500-1350 PSI [35-93 bar] Crack	1
	1864-001	SPRING, Standard, 1351-1750 PSI [93-121 bar] Crack	1
	7638-001	SPRING, S.S., 1351-1750 PSI [93-121 bar] Crack	1
	1451-001	SPRING, Standard, 1751-2000 PSI [121-138 bar] Crack	1
	7078-001	SPRING, S.S., 1751-2000 PSI [121-138 bar] Crack	1
	1865-001	SPRING, Standard, 2001-2600 PSI [138-179 bar] Crack	1
	1870-001	SPRING, S.S., 2001-2600 PSI [138-179 bar] Crack	1
	7497-001	SPRING, S.S., 2601-3200 PSI [179-221 bar] Crack	1
	5	1880-001	CAP, Relief
6	2707-001*	SEAL, O-Ring	1
7	1615-001*	SEAL, O-Ring	1
8	9020-022	RING, Back-Up	1
9	1718-001*	SEAL, O-Ring	1

} Not sold separately.
Order K-19003-A

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-36.

