PARKING THE HANDLER

Precautions

- Avoid parking on slopes or near an excavation.
- Park on level ground and chock wheels.
- Avoid parking on roads or highways. If it cannot be avoided, be sure to display warning flags during day and flares or flashing lights at night.
- Position boom-head or attachment on ground; never leave machine with boom in air.
- If parking on a slope cannot be avoided, position the handler at a right angle across the slope, straighten rear wheels and chock all wheels.

Parking procedure

1. Using service brake, stop the handler in an appropriate parking area.
2. Move parking brake switch to "On".
3. Shift forward/reverse lever to "Neutral".
4. Position boom-head or attachment on ground.
5. Allow engine to cool at idle speed for 3 to 5 minutes, stop engine and remove ignition key.
6. Chock wheels as an extra precaution against rolling.
7. Fill fuel tank to minimize condensation.
8. Lock cab and install protective covers, if so-equipped.
9. Disconnect batteries if unit is in an area where tampering is a risk.

STEERING SYSTEM

- Rear-wheel power steering is provided to reduce operator fatigue and to permit high maneuverability in close quarters.
- It is imperative that the operator practice maneuvering the handler in a safe, open area to become thoroughly familiar with steering response and clearance required for tail swing and load when turning.

⚠ WARNING

Be alert for any increase in effort needed to steer. If any difference is noted, notify maintenance personnel immediately. If power assist feature should fail for any reason, IT WOULD BECOME VERY DIFFICULT TO STEER. For this reason it is extremely important that you NEVER TURN ENGINE OFF WHILE TRAVELING.

In the event power steering fails, stop as soon as possible. Do not drive handler until problem has been corrected.

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LUBRICATION & ROUTINE MAINTENANCE (continued)

Daily or Shift (10 hour Maximum) Lubrication & Maintenance (Service at whichever interval occurs first)

		Lube Symbol	No. of Points
13.	Engine Crankcase Dipstick (level handler and check level - refill as required - item 14 is filler cap)	EO	1
30.	Fuel Filler Cap (fill at end of work shift to minimize condensation)	DF	1
31.	Hydraulic Return Filter Condition Indicator (check indicator with oil at normal operating temperature and engine running at full throttle - replace filter element before by-pass indication is reached or at least annually)	-	1
34.	Hydraulic Level Sight Gauges (level handler, retract all other cylinders and check sight gauges - refill as required)	HF	1
35.	Hydraulic Suction Filter (replace filter element when return filter element is replaced	-	1
41.	Air Cleaner Element Condition Indicator (check for clogged condition (red band showing) and clean or replace element as required)	-	1

Weekly (or 50 Hour) Lubrication & Maintenance (Service at whichever interval occurs first) (include all previous periodic services)

1.	Extend/Retract Cable Sheaves		CG	3
6.	Boom Bottom, Front Slide Bearings (extend boom fully and lube all wear paths - retract and extend boom fully three times and wipe excess lube from bearings)			
	2 section boom:	MG	2	
	3 section boom:	MG	4	
7.	Carriage Tilt Cylinder Pivots		CG	2
8.	Boom Hoist Cylinder Pivots		CG	2
9.	Compensating Cylinder Pivots		CG	2
10.	Boom Head/Carriage Pivot		CG	2
11.	Tires (check for damage and proper inflation) Standard for 522 and 524: 1300 x 24, 8 ply - 45 psi Standard for 534D-6 and 534D-6T 1300 x 24, 12 ply - 65 psi Optional: 13.00 x 24 Radial - 70 psi 522D/524D LoPro: 11R22.5 Radials (common wheel).		-	4
12.	Radiator Fill Cap (check level and refill as required)		-	1
17.	Fuel Filter/Water Separator (with Drain) (replace element)		-	1
19.	Quick Switch Latch		CG	1
26.	Leveling Cylinder Pivots		CG	2
29.	Battery (check terminals)		-	1
36.	Tie Rod Ends		CG	2
37.	Steering Cylinder Rod Pivots		CG	2
38.	Steering Cylinder Barrel Pivots		CG	2
39.	Boom Pivots		CG	2
40.	Front Axle Pivots		CG	2
42.	Rear Axle Pivot		CG	2
43.	King Pins		CG	4

At End of First 50 Hours Only

23.	Planetary Drain Plugs (drain while draining differential)	SL	2
25.	Differential Drain Plug (drain and refill)	SL	1

At End of First 30 Days Only (250 Hours Maximum) Lubrication & Maintenance

- Check torque of all items listed in **Torque Chart** (pg 36)

⚠ CAUTION

Service intervals are based on machine usage of 1500 hours annually. Use of your unit may vary significantly and you must adjust service frequency for your usage to obtain maximum service life. Frequency headings in the following schedule indicate a calendar limit and an operating hour limit. Perform service at whichever interval occurs first.

5 Week (or 250 Hour) Lubrication & Maintenance (Service at whichever interval occurs first) (include all previous periodic services)

2.	Boom Front, Top and Side Slide Bearings (extend boom fully and lube all wear paths - retract and extend boom fully three times and wipe excess lube from bearings)		
	2 section boom:	MG	4
	3 section boom:	MG	12
3.	Boom Rear Slide Bearings (lube paths)	MG	12
4.	Boom Extend Cables (check adjustment and adjust as required)		2
6.	Boom Front Bottom Slide Bearings (to be performed by experienced maintenance person - check for damage and excessive wear - no wear permitted past bevel - maximum clearance at top bearing is 1/8 inch, shim or replace as required; when these bearings require service, check all other slide bearings - shims are 1/16 inch thick)		
	2 section boom:	-	2
	3 section boom	-	4
15.	Engine Oil Filter (replace filter element)	-	1
18.	Vacuator Valve (rubber cone on bottom - check to be sure cone is clear and undamaged)	-	1
20.	Drive Belts (check condition - replace as required)	-	1
21.	Engine Crankcase Drain Plug (drain and refill top level)	EO	1
22.	Rear Hub Level Plug (check level and refill as required)	SL	2
24.	Drive Axle Level Plug (check level and refill as required)	SL	1

- Check torque of all items listed in **Torque Chart** (pg 36)

Quarterly (or 500 Hour) Lubrication & Maintenance (Service at whichever interval occurs first) (include all previous periodic services)

17.	Fuel Filter/Water separator (with Drain) (replace element)	-	1
32.	Hydraulic System (we recommend that hydraulic fluid be analyzed to determine condition - drain and refill reservoir if required	HF	1
33.	Hydraulic Reservoir Screen (remove, clean and install when hydraulic oil is drained)	-	1

Semi-Annual (or 1000 Hour) Lubrication & Maintenance (Service at whichever interval occurs first) (include all previous periodic services)

23.	Rear Hub Drain Plug (drain and refill - item 22 is fill plug)	SL	2
25/27.	Differential and Planetary Drain Plugs (drain, fill to level, wait 5 minutes and fill to level again -item 24 is fill/level plug)	SL	3
28.	Front Axle Breather (clean or replace)	-	1
32.	Hydraulic Reservoir Breather Cap (clean or replace)	-	1

Annual (or 1500 Hour) Lubrication & Maintenance (Service at whichever interval occurs first) (include all previous periodic services)

12.	Engine Cooling System (drain, flush and refill on basis of period suggested by anti-freeze manufacturer)	-	1
31.	Hydraulic Return Filter (replace filter element)	-	1
32.	Hydraulic System (unless fluid is analyzed quarterly to determine degree of contamination, reservoir must be drained and refilled on an annual basis)	HF	1
33.	Hydraulic Reservoir Screen (remove, clean and install when hydraulic oil is drained)	-	1
35.	Hydraulic Suction Filter (replace filter element)	-	1

LUBRICATION ADVICE

- Apply a light coating of engine oil to all linkage pivot points.
- Clean lubrication fittings before lubricating.
- Intervals shown are for normal (8-hour day) usage and conditions. Adjust intervals for abnormal usage and conditions.
- Drain engine and gear cases after operating when oil is hot.
- Check lubricant levels when lubricant is cool.
- Clean filter and air cleaner housing and reusable elements using solvent or diesel fuel. Dry components thoroughly using lint free cloth.

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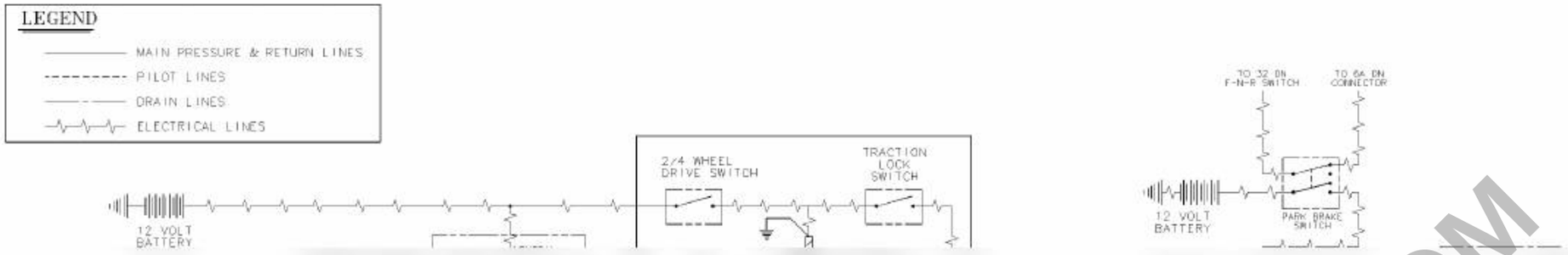
RECOMMENDED LUBRICANTS & CAPACITIES

APPLICATION	SYMBOL	WHEN USED	GRADE	SPECIFICATION	CAPACITY*	
Boom Cable Adj. Threads	MY (moly lube)	All Year	-	P/N 1440-3323	-	-
Boom Slide Bearing Paths	MG (extreme pres. moly lube)	All Year	NLGI #2	**	-	-
Engine Cooling System	AF (anti-freeze)	All Year	½ & ½	Permanent	17.7 qts	16.6 L

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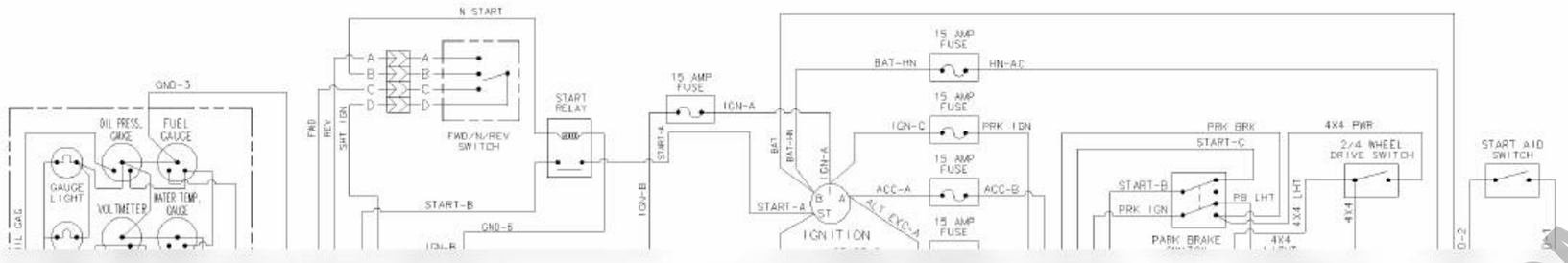
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KEY		
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SAFETY HIGHLIGHTS

Read and understand all manuals and instructional material listed on cover, inside front cover and page 2 of this Manual before starting, operating or performing maintenance procedures on this equipment.

Operators of this equipment must have successfully completed a training program in the safe operation of this type of material handling equipment.

Regardless of previous experience operating similar equipment, the operator must be given sufficient opportunity to practice with the handler in a safe, open area (not hazardous to people or property) to gain operating skills and the proper "feel" for controls and operating clearances required for safe, efficient operation.

The GRADALL Material Handler is equipped with a right-side rear-view mirror. This mirror is intended as an operator's aid and does not replace the requirement for line-of-sight. Certain jobsite and machine conditions may require use of a signal person to help the operator when picking, placing or transporting a load. Never operate the handler until you know pick-up point, line of travel and landing point are clear. Always be aware that objects in mirrors are closer than they appear.

WATCH FOR THESE SYMBOLS; THEY CALL YOUR ATTENTION TO SAFETY NOTICES

⚠ DANGER

This symbol indicates an extreme hazard which would result in high probability of death or serious injury if proper precautions are not taken.

⚠ WARNING

This symbol indicates a hazard which could result in death or serious injury if proper precautions are not taken.

⚠ CAUTION

This symbol indicates a hazard which could result in injury or damage to equipment or property if proper precautions are not taken.

SAFETY PRECAUTIONS

⚠ WARNING

Operator must be seated with seat belt fastened, forward reverse lever in "Neutral" position, parking brake applied and all hydraulic controls in "Neutral" before starting engine.

- Make sure all **DANGER, WARNING, CAUTION** and **INSTRUCTIONAL DECALS** are in place and can be read. Clean or replace decals as required.
- Ensure handler is on a firm, level surface before lifting or placing load. Have surface leveled if necessary. **Unit can tip over if load is raised with handler on a soft or uneven surface.**
- Always look in the direction of travel. **Reduce speed and be especially careful when traveling in reverse and/or turning. Be aware of tail swing due to rear-pivot steering.**
- If load or conditions obstruct view, **use a signal person** when lifting, carrying or placing a load.
- Loose clothing can get caught in moving machinery and can also cause accidental actuation of controls. **Dress properly for the job.**
- **Be alert to any unusual response to controls.** If unusual response is noticed, position handler in a safe area, lower forks to ground, apply parking brake, stop engine and remove key from ignition switch. Tag steering wheel to forbid operation and **notify maintenance personnel.**
- Keep hands, gloves, shoes, control knobs and pedals clean. **Slippery controls can cause accidents.** Keep a firm grip on the steering wheel when traveling.
- **Load capacities are based on load center being within 24 inches from front vertical face of forks.**
- **Never service the handler with the engine running.**
- **Release trapped pressure** before disconnecting, opening or removing any hydraulic component.
- Keep all windows and mirror(s) clean. Adjust mirror(s) as required for maximum visibility, before and during operation.
- ***Never permit diesel engine to run out of fuel.*** *Doing so can cause severe damage.*
- **Whenever leaving the cab, perform standard shut-down procedure:**

STANDARD SHUT-DOWN PROCEDURE

Position the handler in a safe location, apply parking brake, lower forks to ground, move all controls to "Neutral", allow engine to run at low idle for 3 to 5 minutes. Stop engine and remove ignition key. Chock wheels.

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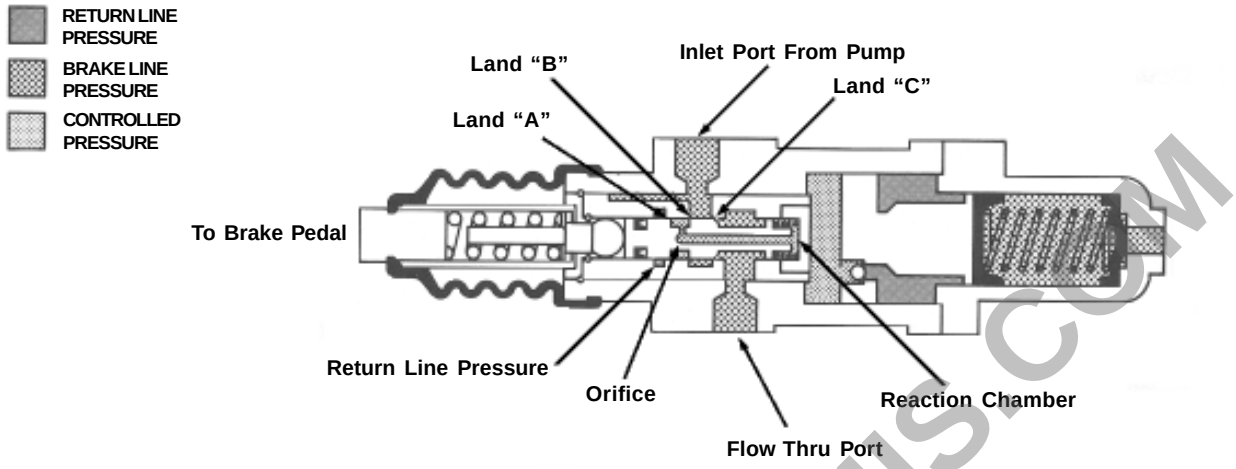
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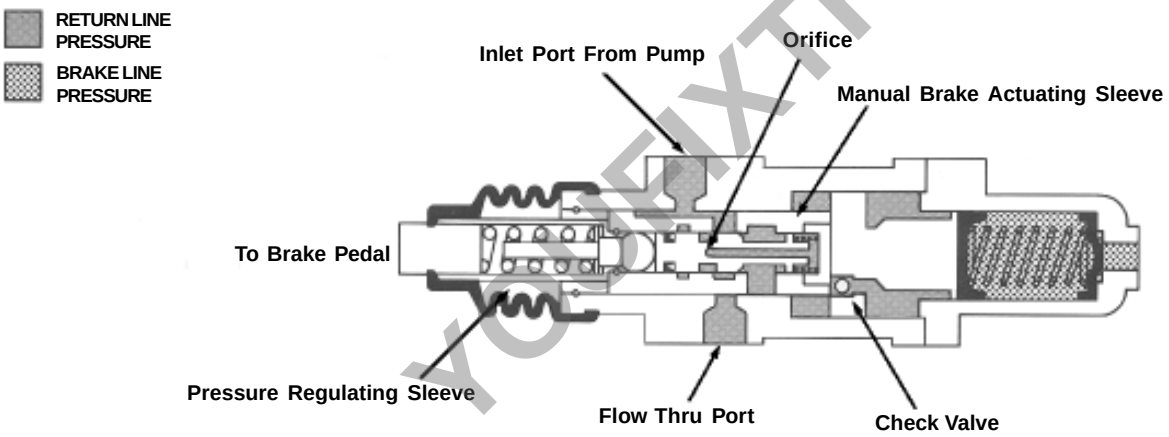
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Hydraulic System Pressure Equal to Brake Line Pressure **FIGURE 4**



Schematic of Brake Valve in Manual Operation **FIGURE 5**



is released. In drum brake systems, this low pressure aids in preventing air from entering the brakes when the vehicle is at rest. The residual valve is removed from models designed for disc brake systems because of the drag which would develop in this type of brake, even at these relatively low pressures.

When force is applied to the brake pedal, this force acts through the PRESSURE REGULATING SPRING to shift the PRESSURE REGULATING SPOOL restricting the flow of oil at LAND "C" to build up pressure when there is no requirement for pressure to the power steering or other hydraulic device (Figure 3). As the pressure builds up, a small amount of oil flows through the ORIFICE and down through the passage inside the spool to the REACTION CHAMBER (Figure 3). At the same time, oil flows along a groove in the outside diameter of the MANUAL BRAKE ACTUATING SLEEVE into the chamber ahead of the MANUAL BRAKE ACTUATING SLEEVE (Figure 2). Flow to the area ahead of the MANUAL BRAKE ACTUATING SLEEVE moves the MASTER CYLINDER PISTON, building up pressure in the MASTER CYLINDER which, in turn, builds pressure in the brake lines. Pressure in the REACTION CHAMBER moves the SPOOL back a small amount against the PRESSURE REGULATING SPRING, and when the hydraulic pressure balances against the PRESSURE REGULATING SPRING the pressure is controlled to the MASTER CYLINDER. The ORIFICE controls the rate of flow to the REACTION CHAMBER; hence, the rate of pressure increases and stability of the pressure regulating spool is controlled. Therefore, system efficiency is maintained since the power brake valve does not momentarily take all of the fluid from the pump. When the pedal effort is released, the spring in the REACTION CHAMBER returns the pressure regulating spool to neutral. This closes LAND "B" to pressure and opens LAND "A" which allows the oil ahead of the spool in the REACTION CHAMBER to flow to the return port as well as the oil ahead of the MANUAL BRAKE ACTUATING SLEEVE. The spring in the MASTER CYLINDER returns the MASTER CYLINDER PISTON.

In case the downstream power hydraulic system requires a pressure that is equal to or greater than

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f. Place removed plain half side gear on top as shown in **Figure 4.10.** Use depth gauge to

Check Rotating Resistance of Differential Gears

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IX. Hydrostatic Transmission Pressure

Reason for Hydrostatic Transmission Pressure check:

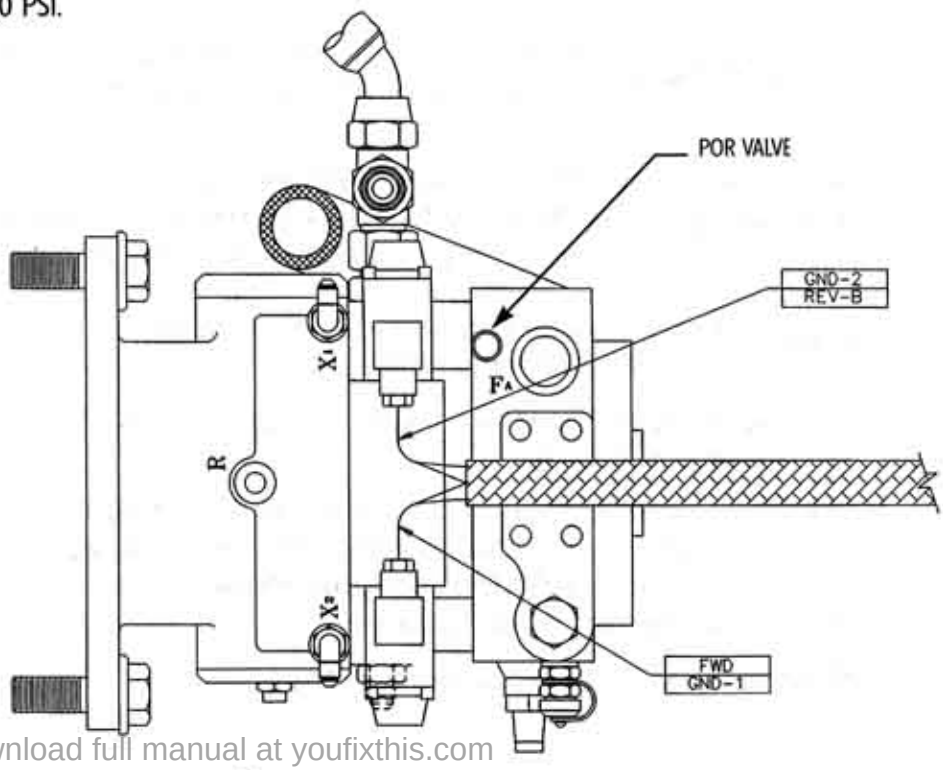
Hydrostatic transmission pressure determines the drive power of the machine. Low drive pressure will result in less power.

Install a high-pressure (10,000 PSI) gauge, hose and adapter on the "MA" port at the bottom of the hydrostatic transmission. ***See Figure 23.*** Apply the park brake and put the 2WD/4WD switch in "2WD". Move the shift lever to "Forward" and run the engine at full throttle. The gauge reading should be 5,500 PSI. Adjust the POR valve (located on top of the hydrostatic transmission) as necessary. ***See Figure 26.*** To adjust this relief valve, loosen the locknut and turn the adjusting screw clockwise to increase pressure; counter-clockwise to decrease pressure. Move the gauge to the "MB" port of the hydrostatic transmission and repeat the procedure with the shift lever in "Reverse".

There are also high-pressure/anti-cavitation relief valves on the hydrostatic transmission. These can adversely affect drive system pressure if they are set too low or an O-ring is missing. Normally, these high-pressure relief valves do not require checking. However, if there is a drive power problem and adjustment of the POR valve on the hydrostatic transmission does not change the pressure, these valves may have to be adjusted. Install a high-pressure (10,000 PSI) gauge, hose and adapter on "MA" port on the hydrostatic transmission. ***See Figure 27.*** To check these high-pressure relief valves, raise the setting on the POR valve on the hydrostatic transmission above 5,800 PSI. Loosen locknut on POR valve and turn the adjusting screw clockwise one turn to increase pressure. ***See Figure 26.*** With a high-pressure (10,000 PSI) gauge, hose and adapter on "MA" port, set the park brake, chock the wheels, put the shifter in "Forward" and run engine at full throttle. Adjust the forward high-pressure relief to 5,800 PSI. The forward high-pressure relief valve is on the bottom of the hydrostatic transmission. Install the high-pressure (10,000 PSI) gauge, hose and adapter on the "MB" port and repeat the procedure for "Reverse". Adjust the reverse high-pressure relief to 5,800 PSI. The reverse high-pressure relief valve locates on top of the hydrostatic transmission. Leave high-pressure (10,000 PSI) gauge, hose and adapter on "MB" port. Reset the POR back to original position. With park brake on and wheels chocked, put the shifter in "Reverse" and run engine at full throttle. The pressure should be 5,500 PSI. Adjust POR valve as required.

The traction lock valve also has two high-pressure/anti-cavitation relief valves. ***See Figure 28.*** Normally, these require no adjustment. However, they can adversely affect drive system pressure if they are set too low or an O-ring is missing. To check these valves, raise the POR valve pressure setting above 5,800 PSI. Set the forward high-pressure relief valve on the hydrostatic transmission to 5,800 PSI. Then lower the forward high-pressure relief valve on the traction lock valve to 5,700 PSI. Turn the valve in 1/8 turn and secure locknut. Repeat the procedure for reverse. Then reset the POR valve to 5,500 PSI.

FIGURE 26
HYDROSTATIC TRANSMISSION
(TOP VIEW)
P/N 9108-3499



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(7B) Retraction Cable Removal

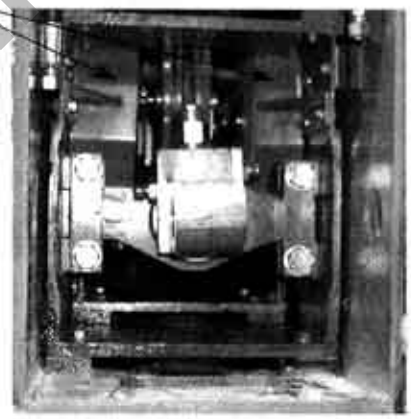
Removal of the retraction cable is a difficult operation; but it can be accomplished. You must be able to reach into the rear of the boom assembly to unfasten the retraction cable socket from the cable anchor bracket weldment. If you can't reach this bracket, the booms must be separated.

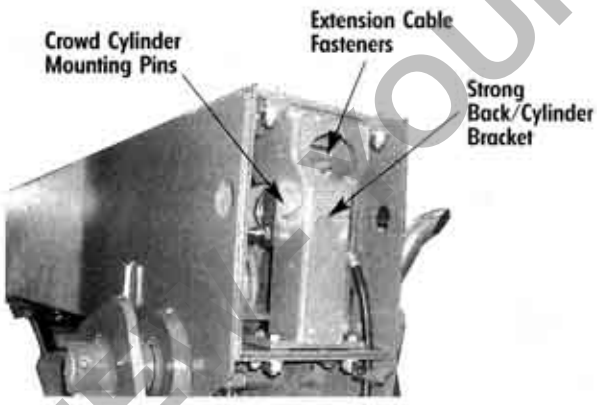
→ Preparation

- Retract the boom assembly fully.
- Remove the keys from the ignition and fasten a "do not operate" tag to the steering wheel. **DO NOT** reach into the boom until you are **CERTAIN** that keys have been removed from the ignition.
- Place the machine in a level, open area with sufficient space to work safely.
- Procure tools and platforms required for this operation.
- Procure a rope to tie to the cable end. This rope must be of sufficient length to allow accessibility whenever the cable is removed. This will assist in reinstallation.
- If working with a helper, be certain each of you know your individual assignments.

→ Stage 1

1. Remove the hose guards from the rear of Boom-Section 1.
2. Remove the crowd cylinder mounting pins from the strong back/cylinder bracket.
3. Remove the extension cable fastener hardware from the strong back/cylinder bracket.
4. Pull the cable free of strong back/cylinder bracket. Fasten a rope to the cable end to aid in reinstallation.
5. Remove the strong back/cylinder bracket mounting hardware.
6. Remove the strong back/cylinder bracket from the rear of the machine.





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