1—2 SERVICE SCHEDULE

Maintenance work must be done at regular intervals. Failure to do so will result in damage to the loader or the engine. The service schedule is a guide for correct maintenance of the Bobcat loader. Do not change from service schedule unless to increase frequency of intervals when the Bobcat loader is operated in very hot, cold, dusty or corrosive conditions.

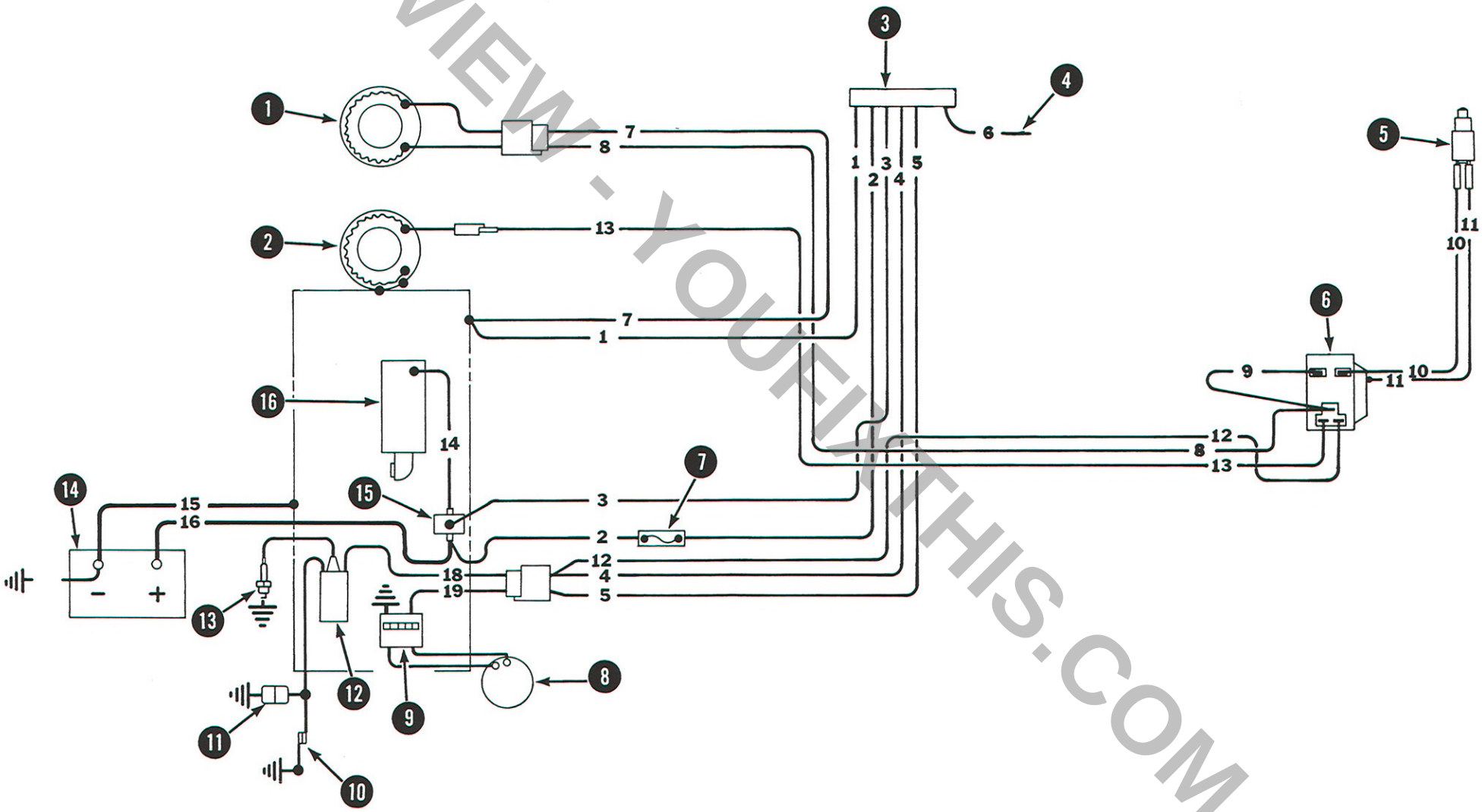
ITEM	SERVICE REQUIRED	HOURS							
		8-10	25	50	100	200	300	500	1000
Engine Air Cleaner	Empty dust cup.	■							
All Loader Pivot, Control Pedals and Levers	Add grease to lubricant fittings until extra grease shows.	■							
Engine Coolant Level (313)	Check level and add coolant if needed.	■							
Engine Oil	Check and add as needed.	■							
■Engine Air Inlet (310)	Check and clean as needed.	■							
Cooling Fins and Shroud (310)	Clean with air pressure.	■							
Engine Oil (310)	Change oil.		■						
Tires	Check tire pressure and add air as needed.		■						
Hydraulic/Transmission Fluid	Check level.		■						
Engine Oil (313)	Change oil and replace oil filter.			■					
Drive Chains	Check tension and adjust as necessary.			■					
Battery	Check electrolyte level and add water as needed.			■					
Lift Arm, Cylinders, Bob-Tach Pivots	Tighten the pivot bolts to 160 ft.-lbs. torque.			■					
Spark Arrestor Muffler	Remove plug. Clean carbon from muffler.				■				
Fan and Alternator Belt (313)	Check tension and adjust as needed.				■				
■Hydraulic Fluid Filter	Replace element.				■				
Belt Sheaves	Check to make sure the sheave mounting screws or nuts are tight. Check electric clutch bracket and wires.				■				
■Crankcase Breather (310)	Inspect. Service as needed.				■				
Steering Clutches	Adjust when lever movement is over 3" in either direction.				■				
Carb. Sed. Bowl (310)	Remove and clean.				■				
Spark Plugs (310)	Remove, clean and set gap. Install and tighten to specification.				■				
Breaker Points (310)	Remove cover. Check contacts and replace if necessary.				■				
■Engine Air Cleaner	Remove and clean. Replace element when necessary.				■				
Engine Cylinder (310)	Remove and clear carbon from cylinder head.					■			
Engine Shroud (310)	Remove to clean cooling fins.					■			
Injector Nozzle (313)	Remove, clean, test and adjust as needed.						■		
Cylinder Head Nuts (313)	Tighten to specifications and adjust valves.						■		
Fuel Filter (313)	Replace the element.						■		
Spark Plug (310)	Replace.						■		
Ignition Timing (310)	Check and adjust as necessary.						■		
Engine Valve Tappets	Check clearance. Adjust as necessary.							■	
Hydraulic/Transmission Fluid	Drain condensation. Check fluid level. Add as needed.							■	
Hydraulic/Transmission Fluid	Replace fluid.								■
Drive Belts	Check for wear. Replace worn belts.								■
Coolant System (313)	Drain system, flush and fill with coolant.								■

■On very dusty conditions, clean more often as needed.

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ENGINE WIRING DIAGRAM
310 (S/N 16152 & ABOVE)



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2 HYDRAULIC SYSTEM

2—1 DESCRIPTION OF HYDRAULIC CIRCUIT

Hydraulic fluid moves from the reservoir to the hydraulic pump. The hydraulic pump forces the fluid through the control valve and back through the hydraulic filter.

This occurs when the control pedals are in neutral. When a control spool is activated to extend the cylinders, fluid is directed into one end of the selected cylinder. Fluid flows from the other end of the double-acting cylinders back to the control valve and through the hydraulic filter to the reservoir. When the control pedal is returned to neutral, fluid is held in the cylinder to hold the load in place.

When a control spool is activated to retract the cylinders, fluid is diverted from one end og the selected cylinders back to the control valve and through the hydraulic filter to the reservoir. When the cylinders reach the end of the stroke or when the load is more than the loader rated lifting capacity, a relief valve opens. The relief valve lets fluid go by the overloaded circuit and return to the reservoir. Do not change the relief valve setting unless a hydraulic check shows that it is too low or too high.

IMPORTANT

When making repairs on hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps or plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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2—1.1 Tubelines, Hoses, Fittings

Since tubelines, hoses and several types of fittings are used in the 310 and 313 hydraulic/hydrostatic systems, certain procedures in maintenance must be used. Wrong tightening procedures and o-ring installation will result in fluid leaks.

The correct method of installation is as follows:

2—1.2 37° Flare Connections

Use the following procedure to tighten the flare fittings:

(1) Tighten the nut until it makes contact with the seat.

(2) Make a mark across the "flats" of both the male and female parts of the connection (Fig. 2—1).

(3) Use the chart below to find the correct tightness needed.

Wrench Size	Tube Size Outside Diameter	Thread Size	Rotate No. of Hex Flats
5/8"	5/16"	1/2 - 20	2-1/2
11/16"	3/8"	9/16 - 18	2
7/8"	1/2"	3/4 - 16	2
1"	5/8"	7/8 - 14	1-1/2 - 2
1-1/4"	3/4"	1-1/16 - 12	1
1-3/8"	1"	1-5/16 - 12	3/4 - 1
2"	1-1/4"	1-5/8 - 12	3/4 - 1
2-1/4"	1-1/2"	1-7/8 - 12	1/2 - 3/4

If the fitting leaks after tightening, disconnect it and inspect the seat area for damage. Replace as needed.

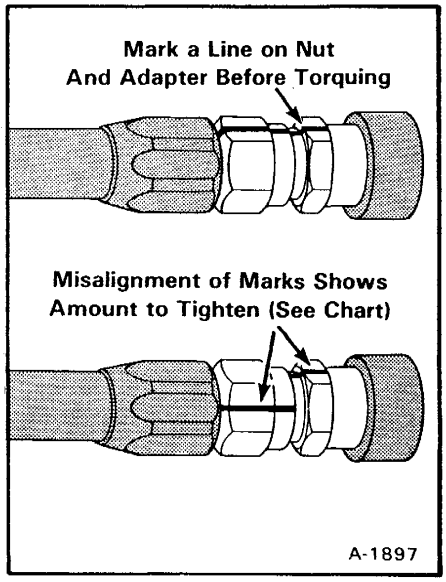


Fig. 2—1 Tightening Flared Fittings

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Disassembly of hydraulic pump:

(1) Remove the key from the pump drive shaft.

(2) Thorougly clean the outside of the pump. Scratch a line across the edges of the cover, gear plate and body to aid in assembly (Fig. 2—2).

(3) Clamp the pump in a vise. Remove the bolts that hold the pump plates together (Fig. 2—3).

(4) Remove the pump from the vise. Separate the plates by striking the shaft onto a wooden block (Fig. 2—4).

(5) Remove these items from the front plate (shaft end) of the pump.

Cessna hydraulic Pump (Fig. 2—5):

Ref.	Description
1	Seat and Check Ball
2	Diaphragm
3	Phenolic Gasket
4	Protector Gasket
5	Diaphragm Seal
6	Shaft Seal
7	Large "O-ring"

Parker hydraulic pump (Fig. 2—6):

Ref.	Description
1	Wearplate
2	Heat Shield
3	Gasket
4	V-Seal
5	O-ring Seal (2)
6	Snap Ring
7	Shaft Seal

(6) Clean and dry all pump parts.

(7) Inspect the pump drive shaft for a broken keyway. Inspect the pump drive shaft and idler gear shaft at bearing points and seal areas. Rough surfaces or wear may be found at these points. Replace the pump if wear is present on the shaft or at the bearing points.

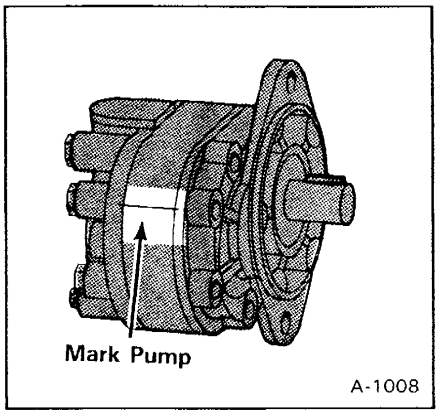


Fig. 2—2 Marking Pump

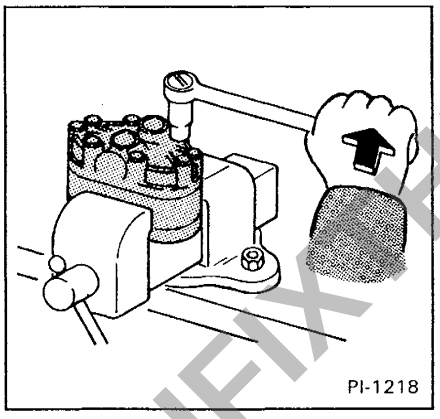


Fig. 2—3 Disassembly of Hydraulic Pump

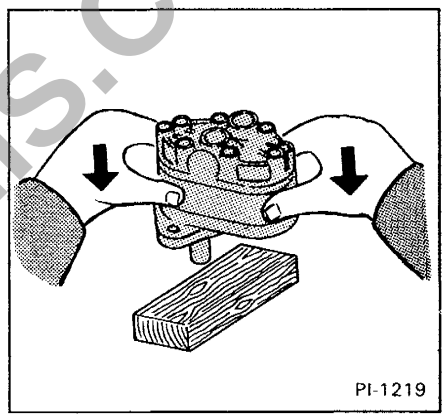


Fig. 2—4 Separation of Plates

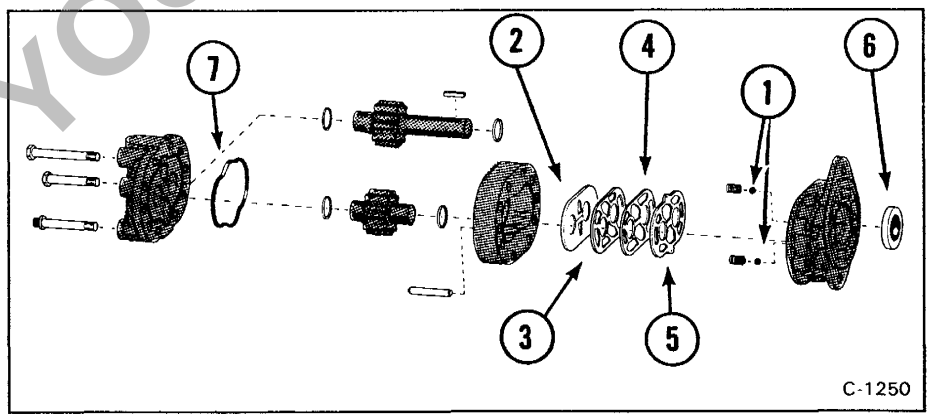


***Fig. 2—5** Cessna Hydraulic Pump

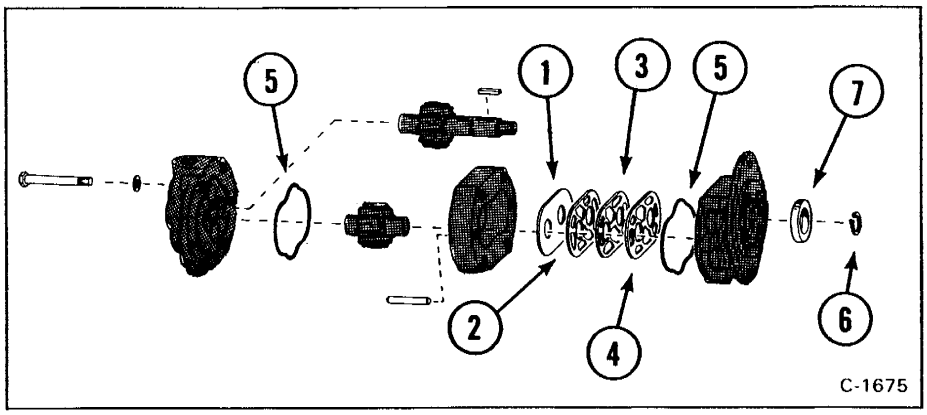


***Fig. 2—6** Parker Hydraulic Pump

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8—4 TORQUE SPECIFICATIONS FOR LOADER

Wheel Bolts	45 - 55 ft.-lbs. (61 - 75 Nm)
Axle Sprocket Bolts	220 - 245 ft.-lbs. (298 - 332 Nm)
Crankshaft Electric Clutch Bolt	45 ft.-lbs. (61 Nm)
Hydraulic Pump Sheave Bolt	20 - 25 ft.-lbs. (27 - 34 Nm)
Steering Lever Bushing Nuts	130 ft.-lbs. (176 Nm)
Upright and Bob-Tach Pivot Bolts	160 ft.-lbs. (217 Nm)
5/8'' Clutch Pin Lock Nut	60 ft.-lbs. (81,4 Nm)
Engine Shock Support Rod Lock Nut	15 - 18 ft.-lbs. (20 - 24 Nm)
Final Drive Idler Bolt (13/16'' Nut)	120 ft.-lbs. (163 Nm)
(3/4'' Nut)	80 ft.-lbs. (108 Nm)

8—5 ENGINE SPECIFICATIONS (310)

8—5.1 Torques

Oil base pan bolt	25 ft.-lbs. (33,9 Nm)
Cylinder head bolt	25 - 30 ft.-lbs. (33,9 - 40,7 Nm)
Connecting rod bolts	25 ft.-lbs. (33,9 Nm)
Flywheel nut	60 - 70 ft.-lbs.81,4 - 95 Nm)
Spark plug	18 - 22 ft.-lbs. (24,4 - 29,8 Nm)
Starter to Engine Bolts	25 - 28 ft.-lbs. (33,9 - 37,9 Nm)

8—5.2 Fits & Clearances

Bore and stroke	3.75 x 3.25 (95,3 x 82,55 mm)
Bore diameter, new	3.75 (95,3 mm)
Crankshaft end play (free)	.003/.020(0,076/0,508 mm)
Crankpin - conn. rod size clearance	.0035'' (0,089 mm)
Crankshaft - conn. rod journal size (Std.)	1.5000/1.4995 (38,1/38,08 mm)
Crankpin length	1.180 (29,972 mm)
Main bearing journal diameter	1.575 (40,005 mm)
Connecting rod to crankpin running clearance	.001/.002 (0,0254/0,0508 mm)
Connecting rod to piston pin clearance	.0003/.0008 (0,0076/0,02032 mm)
Piston pin to piston boss	One Thumb Push Fit
Piston to cylinder bore (thrust face)	.0035/.0045 (0,0889/0,1143 mm)
Piston to cylinder bore (top of skirt)	.007/.010 (0,1778/0,254 mm)
Piston pin diameter (Std.)	.8753 (22,232 mm)
Ring side clearance, top ring	.002/.004 (0,0508/0,1016 mm)
Ring side clearance, middle ring	.002/.004 (0,0508/0,1016 mm)
Ring side clearance, oil ring	.001/.003 (0,0254/0,0762 mm)
Ring end gap	.010/.020 (0,254/0,508 mm)
Ring width, top ring	.093 (2,362 mm)
Ring width, middle ring	.077 (1,9558 mm)
Ring width, oil ring	.187 (4,7498 mm)
Gear reduction shaft end play	.005/.010 (0,127/0,254 mm)
Camshaft pin to camshaft clearance	.001/.0035 (0,0254/0,0889 mm)
Camshaft pin to block (Bearing plate end)	.0005/.002 (0,0127/0,0508 mm)
Camshaft pin to block (P.T.O.E.) (Int.)	.0015/.003 (0,0381/0,0762 mm)
Camshaft pin to breaker cam	.0010/.0025 (0,0254/0,0635 mm)
Camshaft end play	.005/.010 (0,127/0,254 mm)
Valve stem clearance in guide, intake	.0010/.0025 (0,0254/0,0635 mm)
Valve stem clearance in guide, exhaust	.0025/.0040 (0,0635/0,1016 mm)
Valve guide in block (Interference)	.0005/.0020 (0,0127/0,0508 mm)
Valve seat in block (Exhaust) (Interference)	.003/.005 (0,0762/0,127 mm)
Valve clearance, intake (Cold)	.008/.010 (0,2032/0,254 mm)
Valve clearance, exhaust (Cold)	.017/.019 (0,4318/0,4826 mm)
Valve seat angle	44.5°
Valve face angle	45°
Valve seat width	.037/.045 (0,9398/1,143 mm)
Valve tappet clearance in block	.008/.0023 (0,2032/0,05842 mm)
Governor bushing to gov. cross shaft clearance	.0010/.0025 (0,0254/0,0635 mm)
Governor gear to governor shaft	.0005/.0020 (0,0127/0,0508 mm)
Governor cross shaft end play	.005/.030 (0,127/0,762 mm)
Ball bearing to cylinder block (Interference)	.0006/.0022 (0,0152/0,0588 mm)
Ball bearing to bearing plate (Interference)	.0012/.0028 (0,03048/0,07112 mm)
Ball bearing to crankshaft (Int. to loose)	.0004/.0005 (0,01016/0,0127 mm)

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1—3.3 Engine Oil Filter (313)

The 313 oil filter (Fig. 1—8) needs replacement each time the engine oil is replaced (every 50 hours of operation). The oil filter is located in the front of the engine. It is necessary to remove the front two operator enclosure fastening bolts and tilt it to reach the filter.

Use a filter wrench to remove the oil filter. When installing the new oil filter element, turn it on hand tight, only.

To replace the oil and oil filter on the 310 and 313:

(1) Put the loader on a level surface. Stop the engine.

(2) Remove the drain plug and let all the oil out of the engine (Fig. 1—7). (On the 313, the oil drain is located under the alternator.)

(3) Remove the oil filter (313).

(4) Put oil on the gasket on the new oil filter. Install the oil filter and tighten by hand only (313).

(5) Install drain plug.

(6) Put 2 quarts (1,9 liter) of oil in the crankcase on the 310 and put 3.3 quarts (3,1 liter) of oil in the crankcase on the 313.

(7) Start the engine and check for leaks.

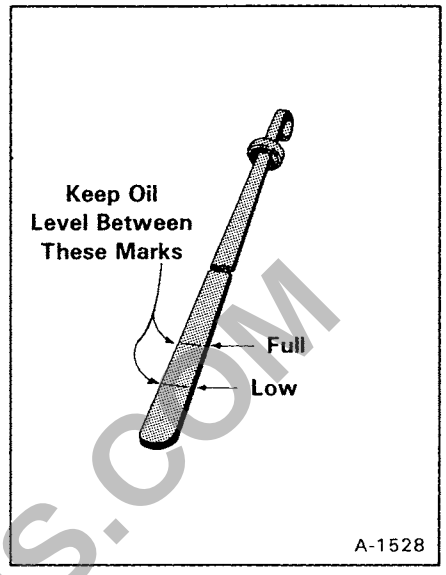


Fig. 1—9 Engine Dipstick

NOTE: Check for a leak at the tubeline on the 313 engine. If there is a leak, replace tubeline with a hose and plug (Fig. 1—9a) (See the Parts Book or Microfiche for the correct part numbers).

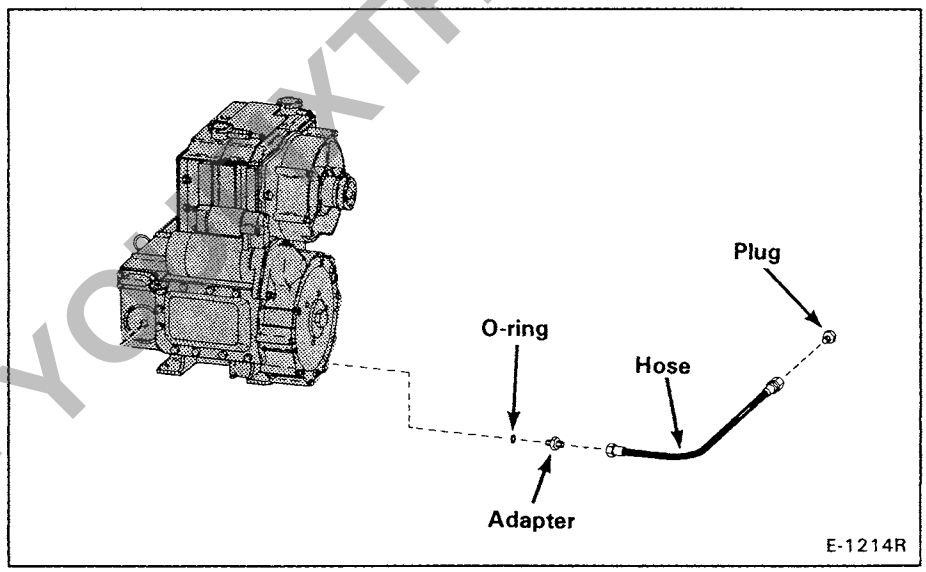


Fig. 1—9a Engine Oil Drain Tubeline

1—3.4 Crankcase Breather (Fig. 1—10)

A crankcase reed type breather is used to keep a slight vacuum in the crankcase.

Remove the components, check the reed valve and gasket and clean the filter every 80 - 100 hours.

Replace the reed valve, gasket and filter after the engine has been reconditioned.

A faulty breather can cause high engine temperature and oil leakage at the engine seals.

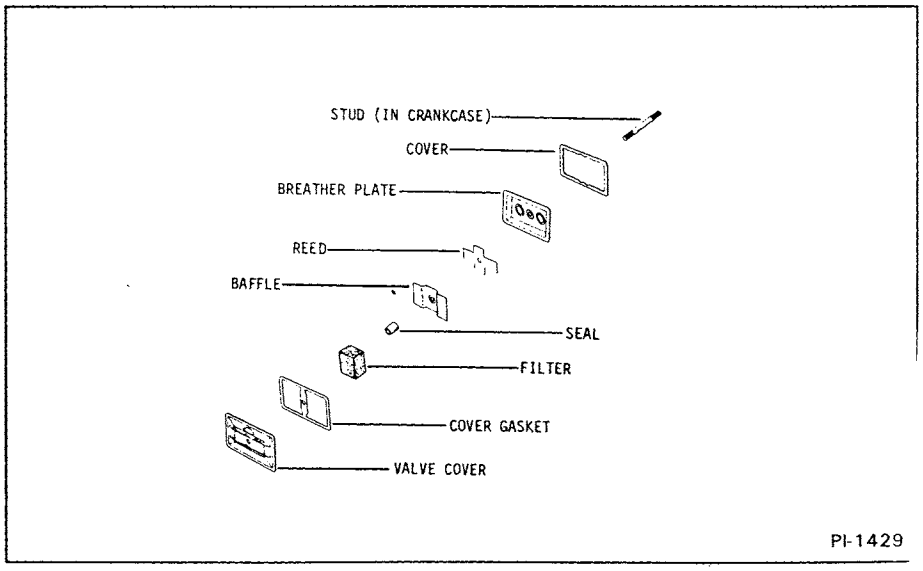


Fig. 1—10 Crankcase Breather (310)

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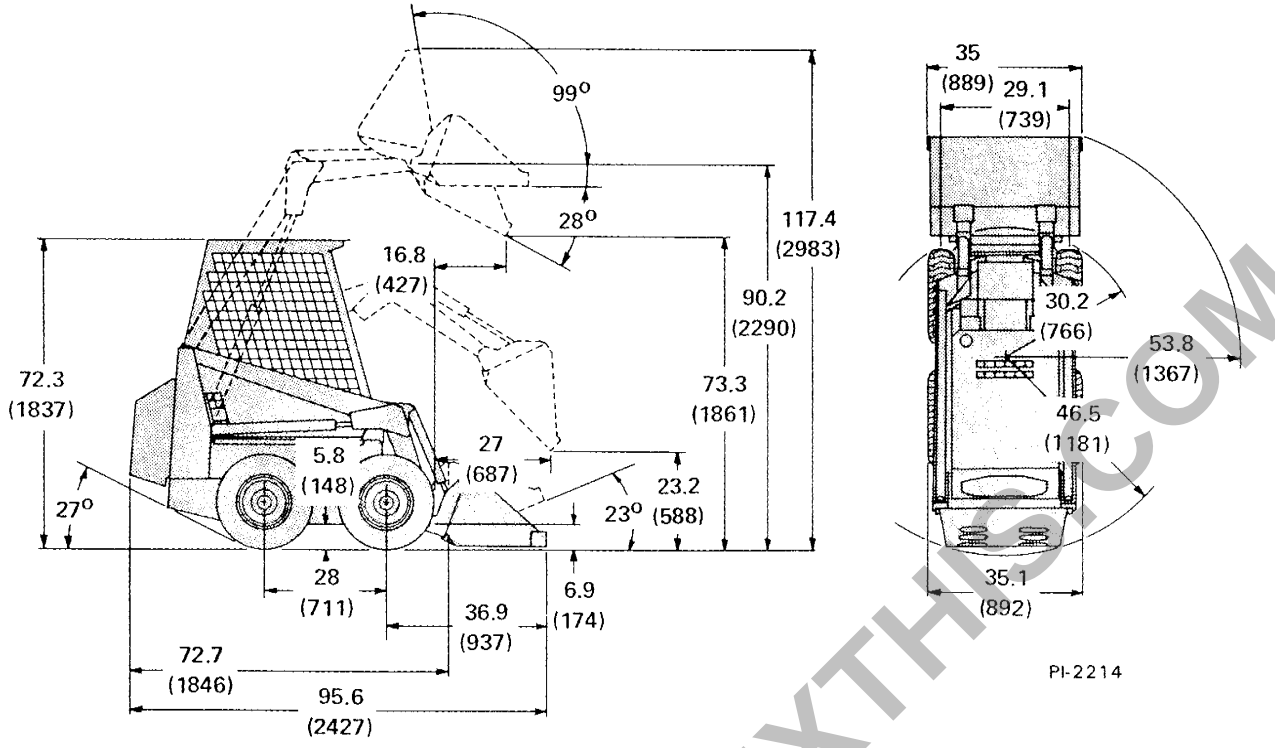
TROUBLESHOOTING THE ELECTRICAL SYSTEM		
PROBLEM	**CAUSE**	**CORRECTION**
Starter will not turn engine.	Loose battery connections.	Clean battery and cable connections. Put cables on battery again and tighten the bolts.
	Battery is in backwards.	Turn the battery and connect the cables to the correct terminal.
	Open fuse in wiring harness.	Check for broken insulation or a broken wire.
	Battery does not have charge.	Charge the battery. Check the rectifier/regulator and output of generator (alternator).
	Starter switch has defect.	Make replacement of starter switch.
	Loose starter connections or battery connections.	Tighten the connections.
	Broken or disconnected wiring harness.	Connect or make replacement of wiring harness.

TROUBLESHOOTING THE ELECTRICAL SYSTEM (313)		
PROBLEM	**CAUSE**	**CORRECTION**
Battery loses charge.	Alternator belt is loose or damaged.	Tighten or replace the belt.
	Battery connection are loose or dirty.	Tighten, clean or replace the battery cable connections.
	Battery is defective.	Check the battery and replace as needed.
	Electrical system does not have the correct ground.	Check all the wires for opens or broken installation.
	Alternator is not charging the battery.	Check the alternator.
		Check for an open diode in the alternator connection.

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310 LOADER SPECIFICATIONS



Dimensions are given for loader equipped with standard tires and dirt bucket and may vary with other bucket types. All dimensions are shown in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Where applicable specifications conform to SAE standard and are subject to change without notice.

OPERATION & PERFORMANCE

Weights
- Operating Weight . . . . . 1980 lbs. (899 kg)
- Rated Operating Capacity . . . . . 500 lbs. (227 kg)
- Tipping Load (SAE Rating) . . . . . 1168 lbs. (539 kg)

Travel Speed:
- Low Range . . . . . 2.5 MPH (4,0 Km/hr.)
- High Range . . . . . 4.7 MPH (7,6 Km/hr.)

Controls
- Vehicle . . . . Forward, reverse & steering functions controlled by two hand levers.
- Travel Speed . . . . . Electric clutch controlled by manually operated switch.
- Loader Function . . Lift, tilt & auxiliary function controlled by separate foot pedals.
- Engine . . . . . Hand lever throttle and key type ignition starter switch.
- Brakes . . . . . mechanical disc, hand operated lever.

ENGINE

Make . . . . . Kohler
Model K341-QS
Fuel . . . . . Gasoline
Horsepower . . . . . 15.4 (11,5 Kw) @ 3000 RPM
Maximum Governed RPM . . . . . 3000 RPM
Torque . . . . . 28.2 ft.-lbs. (38,2 Nm) @ 2600 RPM
Number of Cylinders . . . . . One
Bore/Stroke . . . . . 3.75 (95,3)/3.25 (82,6)
Displacement . . . . . 36 cu. in. (589 cm³)
Cooling System . . . . . Air
Lubrication . . . . . Splash
Crankcase Ventilation . . . . . Internal
Air Cleaner . . . . . Dry Replaceable paper element
Ignition . . . . . 12 volt, battery ignition W/breaker points and coil.

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8—5.3 Maximum Wear Tolerances & Clearances

Specification

CYLINDER BORE

Maximum Oversize Diameter	3.75 (95,25 mm)
Maximum Allowable Taper	.0015 (0,0381 mm)
Maximum Out-of-Round	.005 (0,127 mm)

CRANKSHAFT CRANKPIN

New Crankpin Diameter	1.500 (38,1 mm)
Maximum Out-of-Round	.0005 (0,0127 mm)
Maximum Taper	.001 (0,0254 mm)

CONNECTING ROD

Maximum Wear Diameter - Big End	1.5025 (38,1635 mm)
Rod to Crankpin - Max. Clear.	.0035 (0,0889 mm)

PISTON — THRUST FACE

Maximum Wear Diameter	3.7425 (95,05 mm)

PISTON RING

Maximum Side Clearance	.006 (0,1524 mm)

VALVE STEM TO GUIDE**

Exhaust - Maximum Clearance	.0065 (0,1651 mm)
Intake - Maximum Clearance	.0045 (0,1143 mm)

*Maximum allowable before replacement, reboring regrinding.

**Maximum at top of guide with valve closed.

DIMENSION (See Fig. 8—2)		INTAKE	EXHAUST
A.	SEAT ANGLE	89°	89°
B.	SEAT WIDTH	.037/.045 (0,9398/1,143 mm)	.037/.045 (0,9398/1,143 mm)
C.	INSERT O.D.		
	(Engine # Suffix "A, B&C")	1.5035/1.5045 (38,1889/38,2143)	1.2535/1.2545 (31,8389/31,8643)
	(Engine # Suffix "D")	1.5035/1.5045 (38,1889/38,2143)	1.5035/1.5045 (38,1889/38,2143)
D.	GUIDE DEPTH	1.4688 (37,3075 mm)	1.4688 (37,3075 mm)
E.	GUIDE I.D.	.312/.313 (7,9248/7,9502 mm)	.312/.313 (7,9248/7,9502 mm)
F.	VALVE HEAD DIAMETER		
	(Engine # Suffix "A, B&C")	1.281 (32,537 mm)	1.063 (27 mm)
	(Engine # Suffix "D")	1.281 (32,537 mm)	1.281 (32,537 mm)
G.	VALVE FACE ANGLE	45°	45°
H.	VALVE STEM DIAMETER	.3105/.3110 (7,8867/7,8994 mm)	.3090/.3095 (7,8486/7,8613 mm)

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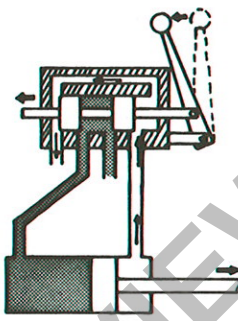
SYSTEM OPERATIONS

310 HYDRAULIC SYSTEM (Chart # PI-2496)

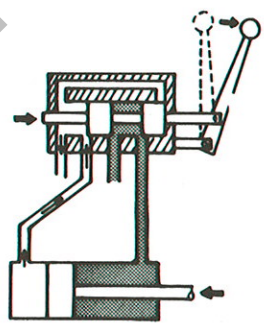


The fluid from the reservoir (chaincase) moves through the port block (7) to the inlet of the hydraulic pump (2). The hydraulic pump (2) is a "gear" pump driven by a belt from a two (2) speed electric clutch. The fluid flows from the hydraulic pump (2) to the control valve (3).

The hydraulic control valve (3) has a adjustable relief valve (5). When all three spools are in neutral position, the fluid goes through the control valve (3) and back to the filter (8). If one of the spools is activated, the fluid goes out the respective port and to either the base end, or the rod end of the cylinders (1) (4). As the fluid goes into one end of the cylinders (1) (4), return fluid comes from the opposite end of the cylinders and back to the control valve (3). When the cylinders (1) (4) reach the end of the stroke, the fluid stops and causes the hydraulic pressure to increase. When the pressure reaches the setting of the relief valve (5), it will open and let the fluid by-pass the hydraulic control valve (internally) and go back to the filter (8). If you let the spool go back to neutral position, then there is fluid available for the other sections. Two sections of the control valve (3) can be used at the same time if the main relief valve (5) is not open.



The fluid flow that goes to the filter (8) is returned to the port block (7) to be used again. The filter (8) is a 10 micron filter with a filter by-pass (9). The filter by-pass (9) will by-pass the fluid when the filter (8) is plugged.



310 HYDRAULIC SYSTEM (Chart #PI-2497)

The fluid moves from the reservoir (chaincase) through the port block (7) to the inlet of the filter (8). From the filter (8) the fluid

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