SUBSECTION 4A
ELECTRICAL SYSTEM

GENERAL

THE ELECTRICAL SYSTEM on the 10, 12, 14 & 16 H.P. models consists of four systems: starting, ignition, charging and accessory, *figure 1.*

THE STARTING SYSTEM contains a 12-volt battery, ammeter, key switch, PTO neutral-start switch, control lever neutral-start switch, solenoid and starter motor.

THE IGNITION SYSTEM includes a 12-volt battery, ammeter, key switch, ignition coil, condenser, breaker points and spark plug(s).

THE CHARGING SYSTEM includes a 12 volt battery, ammeter, key switch, rectifier-regulator and stator.

THE ACCESSORY SYSTEM consists of a 12-volt battery, ammeter, key switch, light switch, headlights, taillights, PTO clutch and PTO switch.

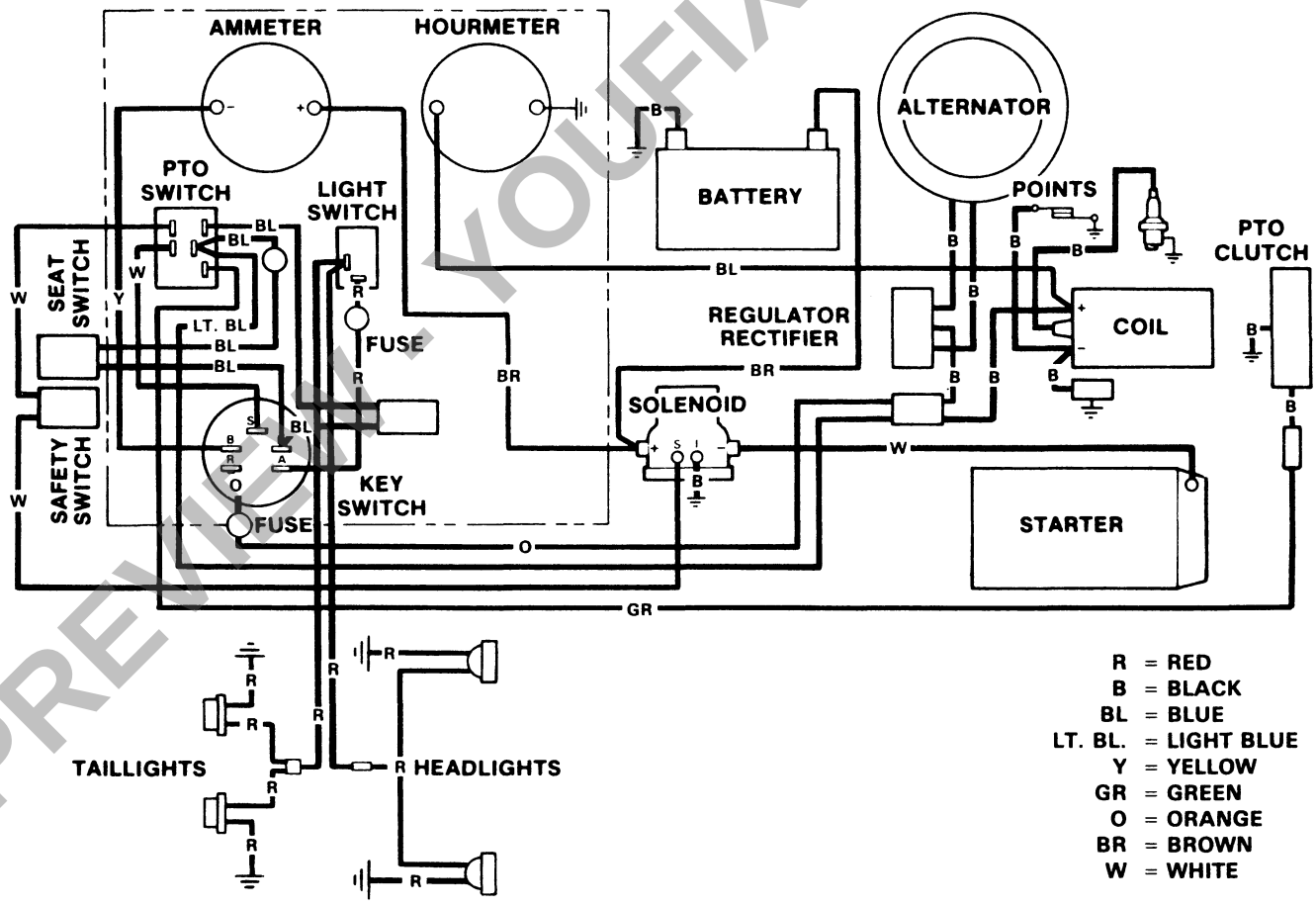
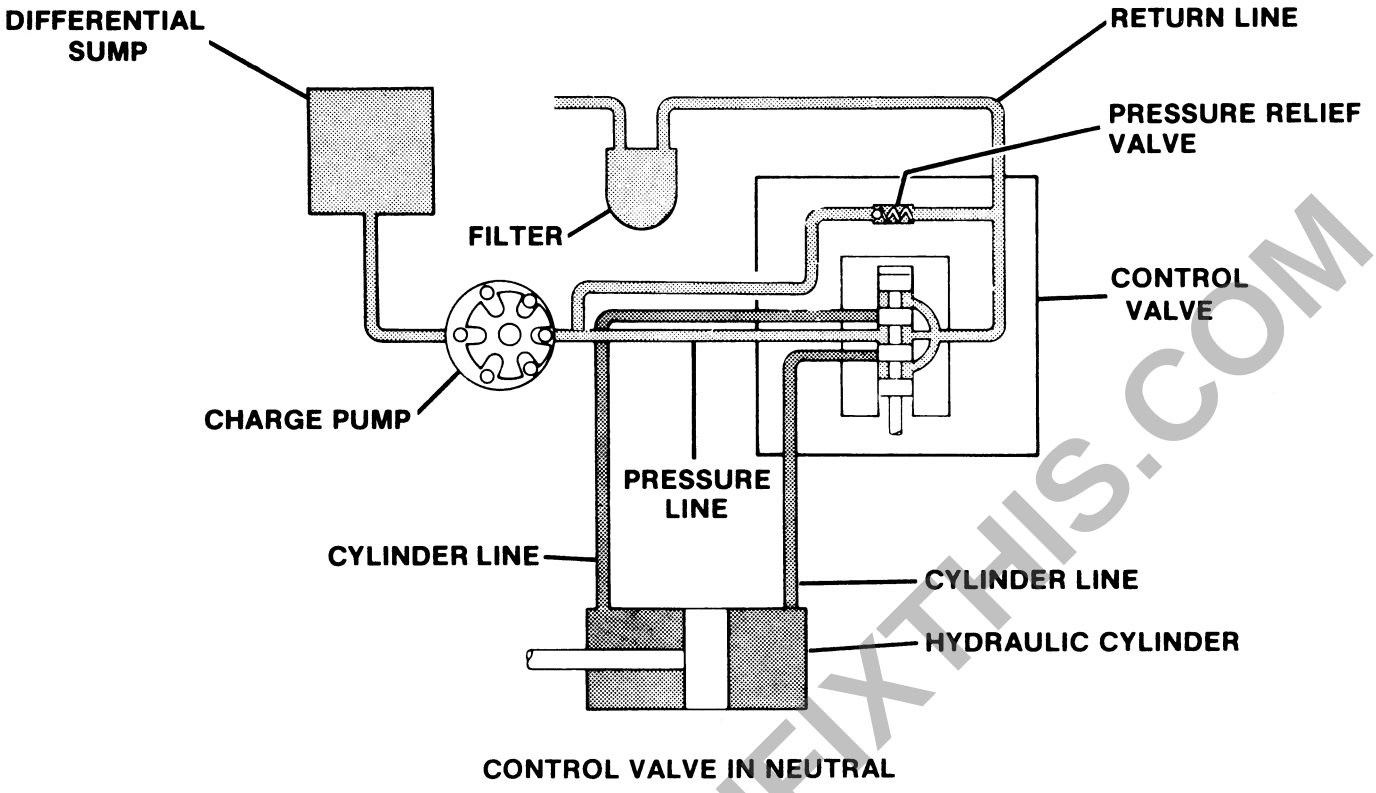


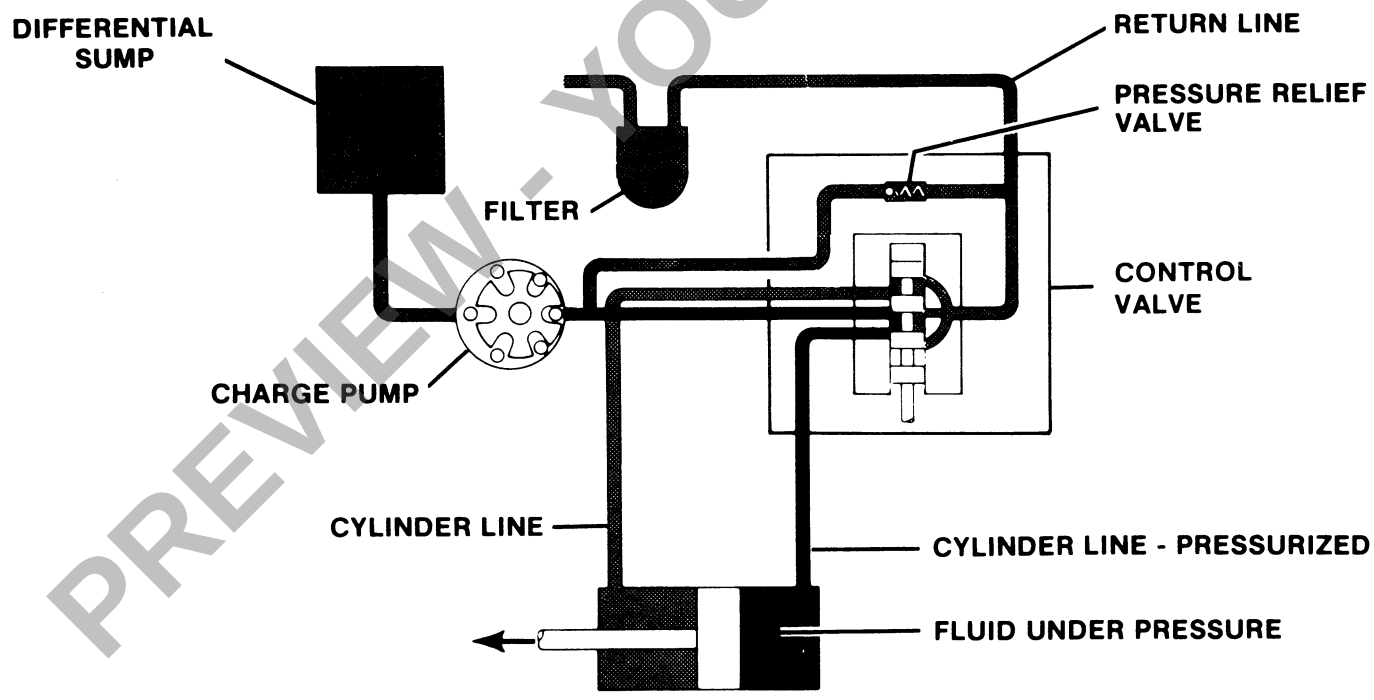
Figure 1. Electrical Schematic (10, 12, 14 & 16 H.P.)

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CONTROL VALVE IN NEUTRAL



CONTROL VALVE IN LIFT MODE

Figure 1 (12, 14, & 16 H.P.)
Diagram of Hydraulic System

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TORQUE CHART
Tolerance ± 10%

SIZE	SAE GRADE #2	SAE GRADE #5	SAE GRADE #8
8-32	19 In./Lbs.	30 In./Lbs.	41 In./Lbs.
8-36	20 In./Lbs.	31 In./Lbs.	43 In./Lbs.
10-24	27 In./Lbs.	43 In./Lbs.	60 In./Lbs.
10-32	31 In./Lbs.	49 In./Lbs.	68 In./Lbs.
1/4-20	66 In./Lbs.	8 Ft./Lbs.	12 Ft./Lbs.
1/4-28	76 In./Lbs.	10 Ft./Lbs.	14 Ft./Lbs.
5/16-18	11 Ft./Lbs.	17 Ft./Lbs.	25 Ft./Lbs.
5/16-24	12 Ft./Lbs.	19 Ft./Lbs.	25 Ft./Lbs.
3/8-16	20 Ft./Lbs.	30 Ft./Lbs.	45 Ft./Lbs.
3/8-24	23 Ft./Lbs.	35 Ft./Lbs.	50 Ft./Lbs.
7/16-14	30 Ft./Lbs.	50 Ft./Lbs.	70 Ft./Lbs.
7/16-20	35 Ft./Lbs.	55 Ft./Lbs.	80 Ft./Lbs.
1/2-13	50 Ft./Lbs.	75 Ft./Lbs.	110 Ft./Lbs.
1/2-20	55 Ft./Lbs.	90 Ft./Lbs.	120 Ft./Lbs.
9/16-18	65 Ft./Lbs.	110 Ft./Lbs.	150 Ft./Lbs.
9/16-20	75 Ft./Lbs.	120 Ft./Lbs.	170 Ft./Lbs.
5/8-11	90 Ft./Lbs.	150 Ft./Lbs.	220 Ft./Lbs.
5/8-18	100 Ft./Lbs.	180 Ft./Lbs.	240 Ft./Lbs.
3/4-10	160 Ft./Lbs.	260 Ft./Lbs.	386 Ft./Lbs.
3/4-16	180 Ft./Lbs.	300 Ft./Lbs.	420 Ft./Lbs.
7/8-9	140 Ft./Lbs.	400 Ft./Lbs.	600 Ft./Lbs.
7/8-14	155 Ft./Lbs.	440 Ft./Lbs.	660 Ft./Lbs.
1-8	220 Ft./Lbs.	580 Ft./Lbs.	900 Ft./Lbs.
1-12	240 Ft./Lbs.	640 Ft./Lbs.	1,000 Ft./Lbs.

NOTES:
1. These torque values are to be for all tractor hardware excluding: locknuts, self-tapping screws, thread forming screws, and sheet metal screws.
2. Unless otherwise noted, all torque values must meet this specification.

BOLT HEAD MARKING

S.A.E. GRADE:

2  5  8 

Standard Tires

20 x 8.00-10 front tires

6 psi (0.422 kg/sq cm)	400 lbs. (181.4 kg)
8 psi (0.562 kg/sq cm)	470 lbs. (213.2 kg)
10 psi (0.703 kg/sq cm)	535 lbs. (242.7 kg)
12 psi (0.843 kg/sq cm)	595 lbs. (270.0 kg)

29 x 12.00-15 rear tires

5 psi (0.351 kg/sq cm)	790 lbs. (358.3 kg)
10 psi (0.703 kg/sq cm)	1185 lbs. (537.5 kg)
15 psi (1.054 kg/sq cm)	1505 lbs. (682.6 kg)

Optional Tires

18 x 8.50 - 8 front tires

6 psi (0.422 kg/sq cm)	380 lbs. (172.4 kg)
8 psi (0.562 kg/sq cm)	450 lbs. (204.1 kg)
10 psi (0.703 kg/sq cm)	515 lbs. (233.6 kg)
12 psi (0.843 kg/sq cm)	570 lbs. (258.5 kg)

26 x 12.00 - 12 rear tires

6 psi (0.422 kg/sq cm)	880 lbs. (399.1 kg)
8 psi (0.562 kg/sq cm)	1040 lbs. (471.7 kg)
10 psi (0.703 kg/sq cm)	1185 lbs. (537.5 kg)
12 psi (0.843 kg/sq cm)	1320 lbs. (598.7 kg)

Maximum load includes weight of tractor, operator, attachments, wheel weights, tire fluid, etc.

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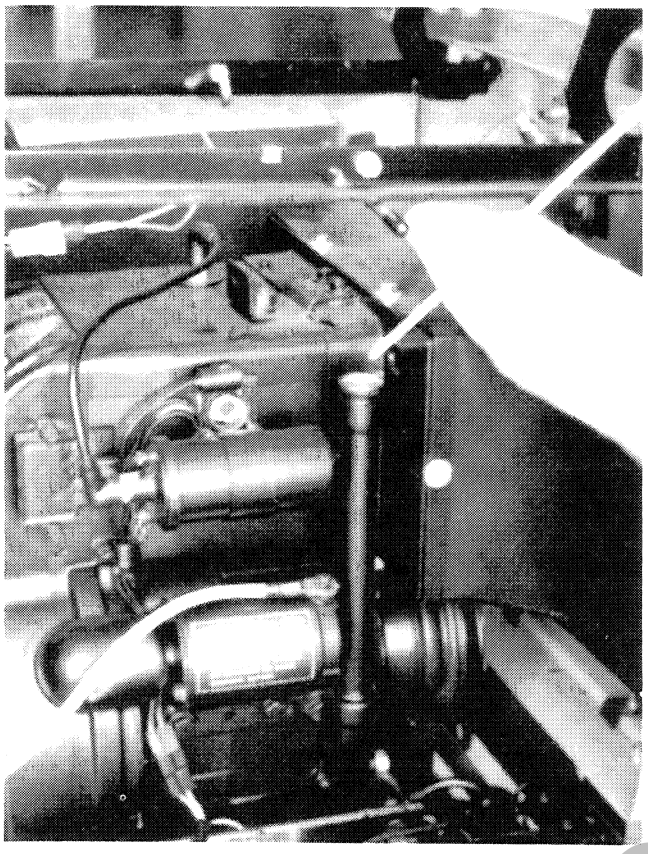


Figure 1 (10, 12, 14 & 16 H.P.)
Checking Engine Oil Level



Figure 2 (19.5 H.P.)
Checking Engine Oil Level

1. Park tractor on a level surface, set parking brake, stop engine and raise hood.

   Install dipstick fully prior to taking reading. An inaccurate reading may lead to overfilling and possible engine seal damage.
2. Wipe dust and dirt from around dipstick. Oil must be between marks on dipstick.

CHANGING ENGINE OIL

Engine should be at operating temperature (after engine has run 5 minutes or more) when oil is drained. When hot, the oil will drain faster removing dirt and other foreign material held in suspension.

To change engine oil, proceed as follows:

1. Park tractor on a level surface, set parking brake, stop engine and raise hood.
2. Remove dipstick, *figure 1* 10, 12, 14 & 16 H.P., *figure 2* 19.5 H.P..
3. Remove side panel.
4. Remove drain plug located at front of engine, *figure 3* 10, 12, 14 & 16 H.P., *figure 4* 19.5 H.P.
5. Drain oil into a suitable container. Replace plug after all oil is drained out.

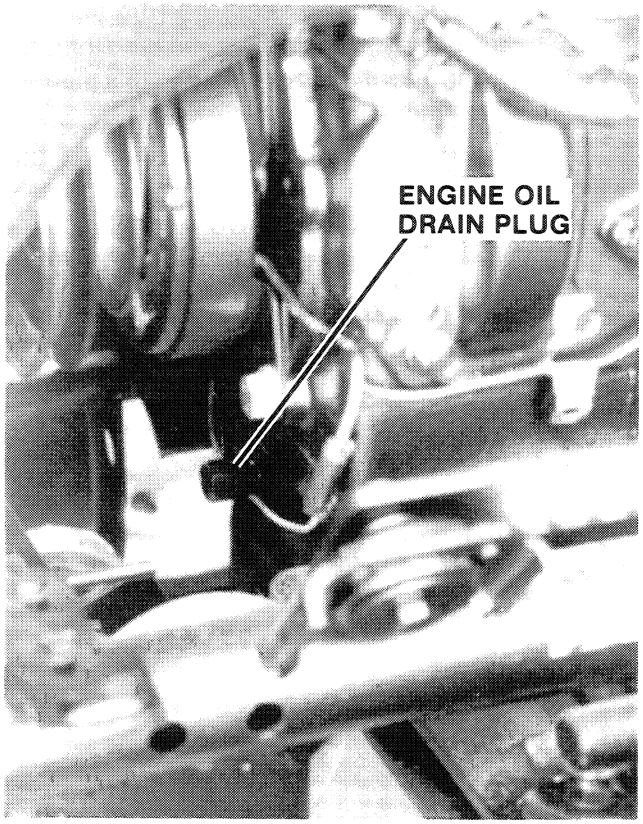


Figure 3 (10, 12, 14 & 16 H.P.)
Engine Oil Drain Plug Location

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TROUBLESHOOTING GUIDE

Problem	Possible Cause	Reference Aids
Lift System Inoperative	Postion control adjusted incorrectly	Adjust position control
	Lift linkage binding	Check for binding and lubricate pivot points
	Low pressure	See "**Problem**-*Low Pressure*" in this trouble-shooting guide.
	Leak in system	Check lines, hoses and components and repair
	Valve stuck	Repair valve, refer to control valve, page 33.
	Lift cylinder rod bent	Repair cylinder, refer to hydraulic cylinders, page 47.
	Dirt in system	Flush system, see Flushing the Hydraulic System, page 23.
Steering System Inoperative	Linkage adjusted incorrectly	Adjust linkage
	Linkage bent or damaged	Replace or repair linkage
	Low pressure (19.5 HP only)	See "**Problem**-*Low Pressure*"
	Leak in system (19.5 HP only)	Check lines, hoses and components and repair
	Valve not centered (19.5 HP only)	Adjust or repair valve, refer to Steering Valve, page 41.
	Cylinder rod bent (19.5 HP only)	Repair cylinder, refer to steering cylinder, page 51.
Low Pressure	Engine RPM too low	Adjust to specifications
	Fluid level low	Check fluid level, see Checking Transaxle Fluid Level, page 15.
	Improper fluid	Replace with proper fluid, see Changing Transmission Fluid, page 16.
	Filter clogged or dirty	Replace filter with proper fluid, see Changing Hydraulic Oil Filter, page 16.
	Leak in system	Repair leak
	Relief valve stuck open	Adjust or replace relief valve, refer to Hydraulic System Pressure, page 23.
	Charge pump worn	Replace charge pump
	Hydraulic line bent or twisted	Repair or replace line, refer to Hydraulic Lines and Couplers, page 31.
	Dirt in system	Flush system, see Flushing Hydraulic System, page 23.

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TRACTOR SPECIFICATIONS

10 H.P. TRACTOR (Gear)

Engine

Manufacturer	Kohler
Model Number	K241AQS Spec no. 4674O-D
Cylinder	1
Type	4-cycle — air cooled
Bore	3 1/4" (82.5 mm)
Stroke	2 7/8" (73.0 mm)
Displacement	23.9 cu. in. (390 cc)
Horsepower (at 3600 rpm)	10.6 (7.8 kw)

Power Train

Transaxle	Peerless model 2306A
Brakes	Rear wheel — drum & band

Electrical System

Battery	12 volt (22 amp) (BC1)
Ignition	Battery coil
Spark Plug	Champion H-10 Champion RH-10 (resistor)
Spark Plug Gap	.025" (0.635mm)
Breaker Point Gap	0.20" (0.508mm)
Charging Capacity	15 amps.

Capacities

Fuel Tank	3 gal. (11.36 l)
Crankcase	1 1/2 qts. (1.42 l)
Transaxle	2 qts. (1.9 l)

Ground Speeds (at 3200 engine rpm with standard tires)

1st	0.83 mph
2nd	2.47 mph
3rd	4.42 mph
4th	6.51 mph
Reverse	2.91 mph

Tires

Standard

Front	16x6.50x8
Rear	23x8.50x12

Optional

Rear Bar Type	23x8.50x12

Tire Pressure

Front	8 psi (0.562 kg/sq. cm)
Rear	8 psi (0.562 kg/sq. cm)

PTO

Front std.	Engine speed
Front opt.	540 rpm
Rear opt.	3300 rpm

Hitch, Rear

Std. — Fixed Drawbar Uses 3/4" Hitch Pin
Opt. — Sleeve

12 H.P. TRACTOR (Gear)

Engine

Manufacturer	Kohler
Model Number	K301AQS Spec. no. 47606-D
Cylinder	1
Type	4 cycle — air cooled
Bore	3 3/8" (85.7 mm)
Stroke	3 1/4" (82.5 mm)
Displacement	29.07 cu. in. (475 cc)
Horsepower (at 3600 rpm)	12 (8.9 kw)

Power Train

Transaxle	Peerless model 2306A
Brakes	Rear wheel — drum & band

Electrical System

Battery	12 volt (22 amp) (BC 1)
Ignition	Battery coil
Spark Plug	Champion H-10 Champion RH-10 (resistor)
Spark Plug Gap	.025" (0.635 mm)
Breaker Point Gap	.020" (0.508 mm)
Charging Capacity	15 amps

Capacities

Fuel Tank	3 gal. (11.36 l)
Crankcase	1 1/2 qts. (1.42 l)
Transaxle	2 qts. (1.9 l)

Ground Speeds (at 3200 engine rpm with standard tires)

1st	0.83 mph
2nd	2.47 mph
3rd	4.42 mph
4th	6.51 mph
Reverse	2.91 mph

Tires

Standard

Front	16x6.50x8
Rear	23x8.50x12

Optional

Rear Bar Type	23x8.50x12

Tire Pressure

Front	8 psi (0.562 kg/sq. cm)
Rear	8 psi (0.562 kg/sq. cm)

PTO

Front std.	Engine speed
Front opt.	540 rpm
Rear opt.	3300 rpm

Hitch, Rear

Std. — Fixed Drawbar Uses 3/4" Hitch Pin
Opt. — Sleeve

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LUBRICATION CHART
10 & 12 H.P. GEAR TRACTOR

REF.	PART NAME	LUBRICANT	LUBRICATION INTERVAL 30 HOURS	LUBRICATION INTERVAL 60 HOURS	REMARKS
1	Grease Fittings (2) Front Wheels	Chassis Grease	●		Fill slowly with grease gun until grease begins to seep out
2	Grease Fittings (2) Each End of Front Axle	Chassis Grease	●		Fill slowly with grease gun until grease begins to seep out
3	Grease Fitting (1) Steering Gear	SAE 90 Oil	●		Fill slowly with grease gun until grease begins to seep out
4	Front Power Take-Off	Chassis Grease	●		Apply around tension springs
5	Grease Fitting (1) Right Angle Gear Box	Chassis Grease	●		Fill slowly with grease gun until grease begins to seep out
6	Brake Adjusting Spring	Chassis Grease	●		Apply around spring
7	Lift Quadrant	Chassis Grease	●		Apply generously
8	Implement Lift Handle	SAE 30 Oil	●		Spring and rod inside handle
9	Implement Lift Linkage	SAE 30 Oil		●	All sliding surfaces, slotted holes and pivot points
10	Idler and Spring Tension Arms and Pivot Rod	SAE 30 Oil		●	All connection points
11	Brake Links and Pins	SAE 30 Oil		●	Caution - do not get oil between brake drum and brake band
12	Brake Rod Pivot	SAE 30 Oil		●	Linkage pivot points
13	Steering Linkage	SAE 30 Oil		●	Outboard bearing and linkage pivot points
14	Parking Brake Lock	SAE 30 Oil		●	Linkage pivot points
15	Clutch and Brake Pivot Shaft	SAE 30 Oil		●	Linkage pivot points
16	4-Speed Transaxle	SAE 90 Oil	●		Fill to required level
17	Engine Air Filter Dry Type			●	Remove element after 60 hours and tap lightly on flat surface to remove loose dirt. Replace after 120 hours (more frequently under extremely dirty or dusty conditions).
18	Engine Crankcase Oil Change	Per Mfg. Rec.	●		See operators manual

Lubricate your tractor on a definite schedule. The rear axle bearings are prepacked and sealed at the factory and need no further lubrication. Apply a few drops of SAE 30 Oil as required to other moving parts not listed above.

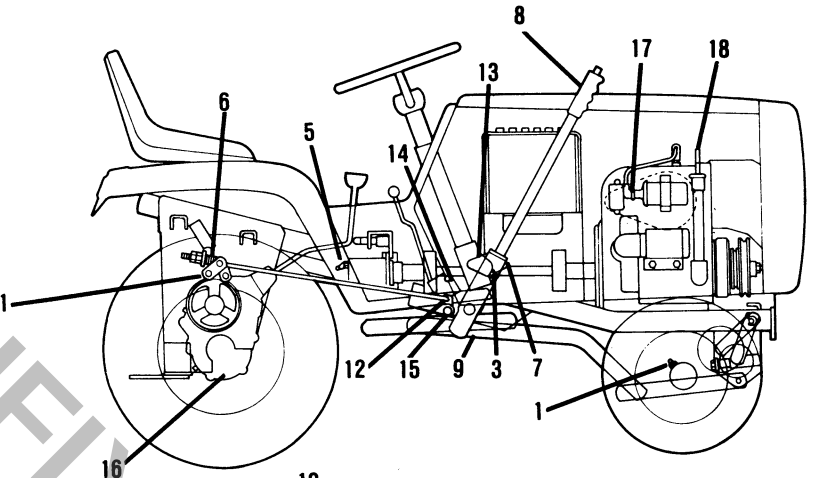
Lubricant:
SAE 30 Oil

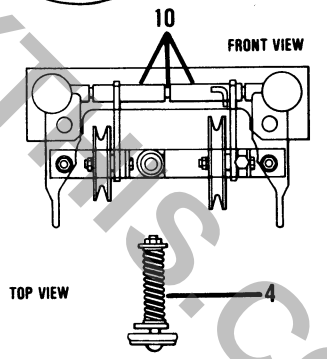
Sources: Sunray DX; Mobil Oil

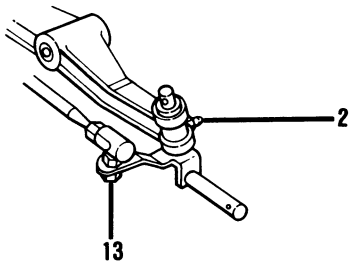
Chassis Grease - Pressure Gun Grease
Sources: Sunray DX #671; Gulf Supreme #0

SAE 90 Oil
Sources: Elco Gear Safety; Exxon Gear Oil "LC"; Mobil Mobilube "46"; Texaco Gear Lube "HD-90".

R.H. SIDE VIEW







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THE ELECTRICAL SYSTEM on the 19.5 H.P. models consists of four systems: starting, ignition, charging and accessory, *figure 2.*

THE STARTING SYSTEM contains a 12-volt battery, ammeter, key switch, PTO neutral-start switch, control lever neutral-start switch, solenoid and starter motor.

THE IGNITION SYSTEM includes a 12-volt battery, ammeter, key switch, hourmeter, ignition coil, condenser, breaker points and spark plug(s).

THE CHARGING SYSTEM includes a 12 volt battery, ammeter, key switch, rectifier-regulator and stator.

THE ACCESSORY SYSTEM consists of a 12-volt battery, ammeter, key switch, light switch, headlights, taillights, PTO clutch and PTO switch.

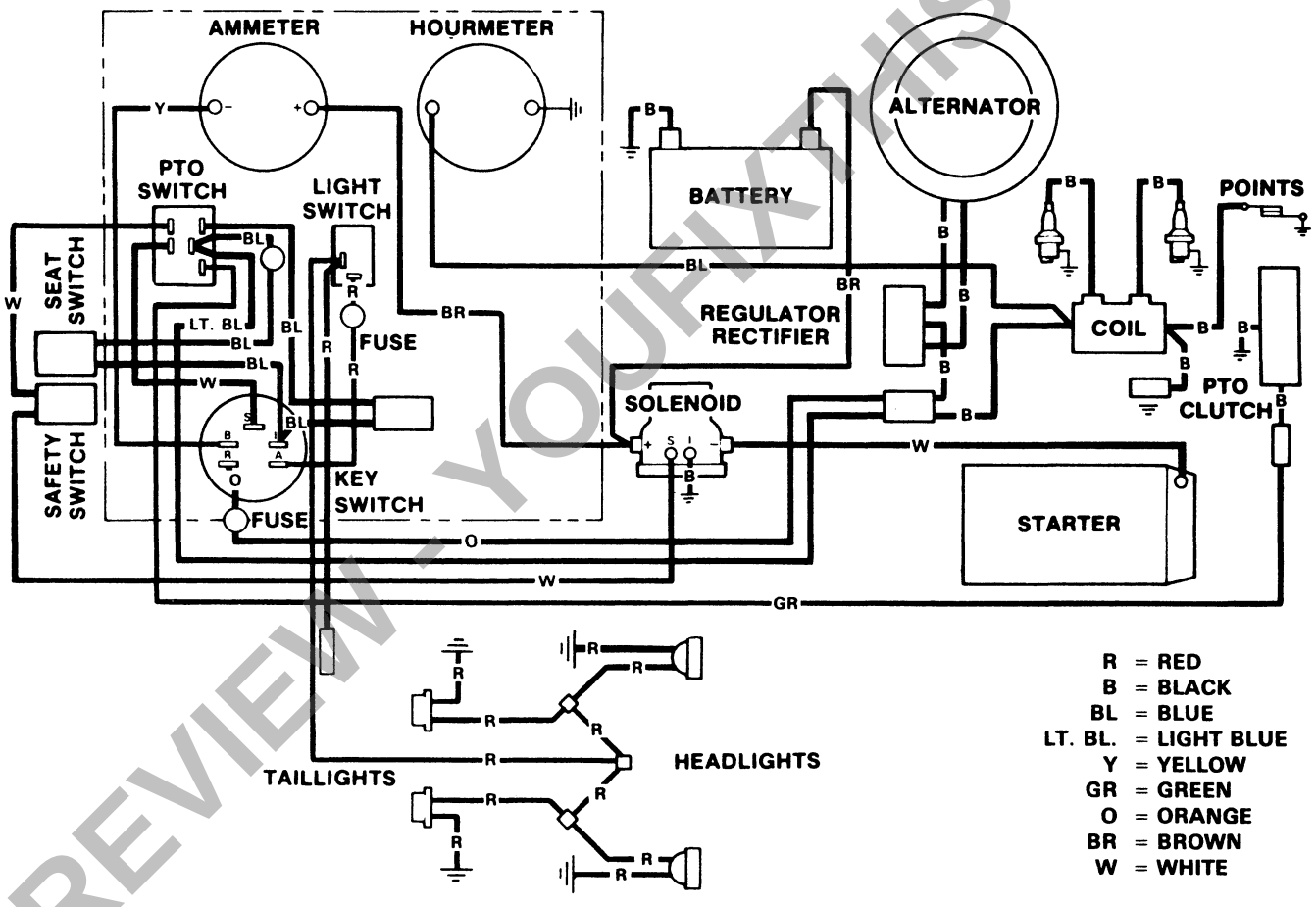
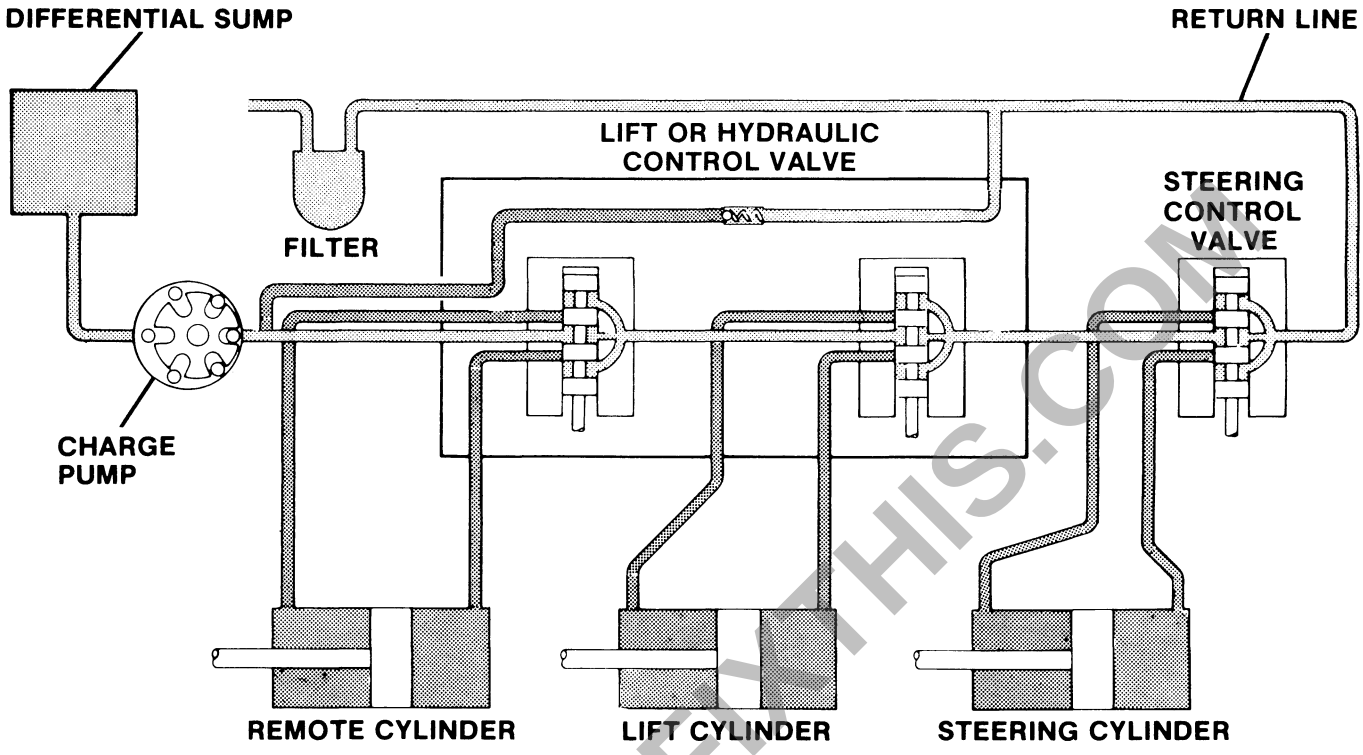


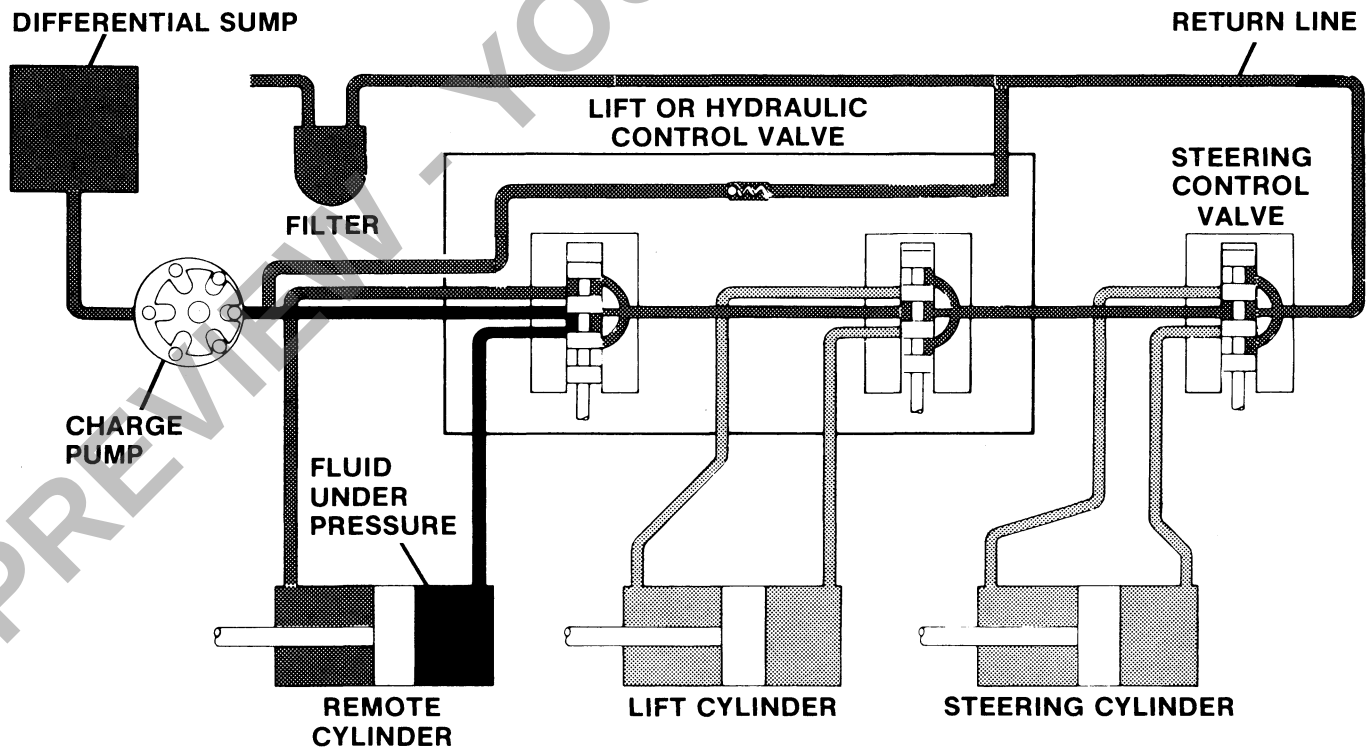
Figure 2. Electrical Schematic (19.5 H.P.)

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CONTROL VALVE IN NEUTRAL



CONTROL VALVE IN LIFT MODE

Figure 2 (19.5 H.P.)
Diagram of Hydraulic Circuit

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FITS AND TOLERANCES

SPECIFICATION	K241	K301	K321	K341
DISPLACEMENT				
Cubic Inches	23.9	29.07	31.27	35.89
Cubic Centimeters	391.65	476.37	528.46	588.24
HORSEPOWER				
(Max. RPM)	10.0	12.0	14.0	16.0
CYLINDER BORE				
New Diameter	3.251 (8.2575 cm)	3.375 (8.5725 cm)	3.500 (8.8900 cm)	3.750 (9.5250 cm)
Max. Wear Diameter	3.2545 (8.2664 cm)	3.3785 (8.5812 cm)	3.503 (8.8976 cm)	3.753 (9.5326 cm)
Maximum Taper	.0015 (.0381 mm)	.0015 (.0381 mm)	.0015 (.0381 mm)	.0015 (.0381 mm)
Max. Out of Round	.005 (.127 mm)	.005 (.127 mm)	.005 (.127 mm)	.005 (.127 mm)
CRANKSHAFT				
End Play (Free)	.003/.020 (.076/.508 mm)	.003/.020 (.076/.508 mm)	.003/.020 (.076/.508 mm)	.003/.020 (.076/.508 mm)
CRANKPIN				
New Diameter	1.500 (3.81 cm)	1.500 (3.81 cm)	1.500 (3.81 cm)	1.500 (3.81 cm)
Max. Out of Round	.0005 (.0127 mm)	.0005 (.0127 mm)	.0005 (.0127 mm)	.0005 (.0127 mm)
Maximum Taper	.001 (.025 mm)	.001 (.025 mm)	.001 (.025 mm)	.001 (.025 mm)
CAMSHAFT				
Run Clear. on Pin	.001/.0035 (.025/.0889 mm)	.001/.0035 (.025/.0889 mm)	.001/.0035 (.025/.0889 mm)	.001/.0035 (.025/.0889 mm)
End Play	.005/.010 (.127/.254 mm)	.005/.010 (.127/.254 mm)	.005/.010 (.127/.254 mm)	.005/.010 (.127/.254 mm)
CONNECTING ROD				
Big End Max. Dia.	1.5025 (3.8164 cm)	1.5025 (3.8164 cm)	1.5025 (3.8164 cm)	1.5025 (3.8164 cm)
Rod-Crankpin Max. Clear.	.0035 (.0889 mm)	.0035 (.0889 mm)	.0035 (.0889 mm)	.0035 (.0889 mm)
Small (Pin) End-New Dia.	.85975 (2.1837 cm)	.87585 (2.1837 cm)	.87585 (2.1837 cm)	.87585 (2.1837 cm)
Rod To Pin Clearance	.0003/.0008 (.0076/.0203 mm)	.0003/.0008 (.0076/.0203 mm)	.0003/.0008 (.0076/.0203 mm)	.0003/.0008 (.0076/.0203 mm)
PISTON				
Thrust Face-Max. Wear Dia.	3.2445 (8.2410 cm)	3.3625 (8.5408 cm)	3.4945 (8.8760 cm)	3.7425 (9.5059 cm)
Thrust Face-Bore Clear.	.0075/.0085 (.1905/.2159 mm)	.0065/.0095 (.1651/.2413 mm)	.007/.010 (.178/.254 mm)	.007/.010 (.178/.254 mm)
Ring-Max. Side Clearance	.006 (.152 mm)	.006 (.152 mm)	.006 (.152 mm)	.006 (.152 mm)
Ring-End Gap In New Bore	.010/.020 (.254/.508 mm)	.010/.020 (.254/.508 mm)	.010/.020 (.254/.508 mm)	.010/.020 (.254/.508 mm)
Ring-End Gap In Used Bore	.027 (.685 mm)	.030 (.762 mm)	.030 (.762 mm)	.030 (.762 mm)
VALVE-INTAKE				
Valve-Tappet Cold Clear.	.008/.010 (.203/.254 mm)	.008/.010 (.203/.254 mm)	.008/.010 (.203/.254 mm)	.008/.010 (.203/.254 mm)
Valve Lift (Zero Lash)	.324 (.8229 cm)	.324 (.8229 cm)	.324 (.8229 cm)	.324 (.8229 cm)
Stem To Guide Max. Wear Clear.	.0045 (.1145 mm)	.0045 (.1145 mm)	.0045 (.1145 mm)	.0045 (.1145 mm)
VALVE-EXHAUST				
Valve-Tappet Cold Clear	.017/.020 (.4318/.508 cm)	.017/.020 (.4318/.508 cm)	.017/.020 (.4318/.508 cm)	.017/.020 (.4318/.508 cm)
Valve Lift (Zero Lash)	.324 (.8229 cm)	.324 (.8229 cm)	.324 (.8229 cm)	.324 (.8229 cm)
Stem To Guide Max. Wear Clear.	.0065 (.165 mm)	.0065 (.165 mm)	.0065 (.165 mm)	.0065 (.165 mm)
TAPPET				
Clearance In Guide	.0008/.0023 (.0203/.0585 mm)	.0008/.0023 (.0203/.0585 mm)	.0008/.0023 (.0203/.0585 mm)	.0008/.0023 (.0203/.0585 mm)
IGNITION				
Spark Plug Gap-Gasoline	.025 (.635 mm)	.025 (.635 mm)	.025 (.635 mm)	.025 (.635 mm)
Spark Plug Gap-Gas	.018 (.4572 mm)	.018 (.4572 mm)	.018 (.4572 mm)	.018 (.4572 mm)
Spark Plug Gap (Shielded)	.020 (.508 mm)	.020 (.508 mm)	.020 (.508 mm)	.020 (.508 mm)
Breaker Point Gap	.020 (.508 mm)	.020 (.508 mm)	.020 (.508 mm)	.020 (.508 mm)
Trigger Air Gap (Breakerless)	.005/.010 (.127/.254 mm)	.005/.010 (.127/.254 mm)	.005/.010 (.127/.254 mm)	.005/.010 (.127/.254 mm)
Spark Run °B.T.D.C.	20°	20°	20°	20°
Spark Retard	3° ATDC (ACR-NONE)	3° ATDC (ACR-NONE)	ACR ONLY (No Retard)	ACR ONLY (No Retard)
TORQUE VALUES				
Spark Plug (Foot Lbs)	18-22 (2.48-3.03 kg/m)	18-22 (2.48-3.03 kg/m)	18-22 (2.48-3.03 kg/m)	18-22 (2.48-3.03 kg/m)
Cylinder Head	25-30 ft. lbs (3.45-4.14 kg/m)	25-30 ft. lbs (3.45-4.14 kg/m)	25-30 ft. lbs (3.45-4.14 kg/m)	25-30 ft. lbs (3.45-4.14 kg/m)
Connecting Rod	300 in lbs (3.44 kg/cm)	300 in lbs (3.44 kg/cm)	300 in lbs (3.44 kg/cm)	300 in lbs (3.44 kg/cm)
Flywheel Nut	60-70 ft. lbs (8.28-9.66 kg/m)	60-70 ft. lbs (8.28-9.66 kg/m)	60-70 ft. lbs (8.28-9.66 kg/m)	60-70 ft. lbs (8.28-9.66 kg/m)

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REMOVAL. To remove the control valve for repair or replacement, proceed as follows:

1. Raise hood and remove side panels, *figure 2.*

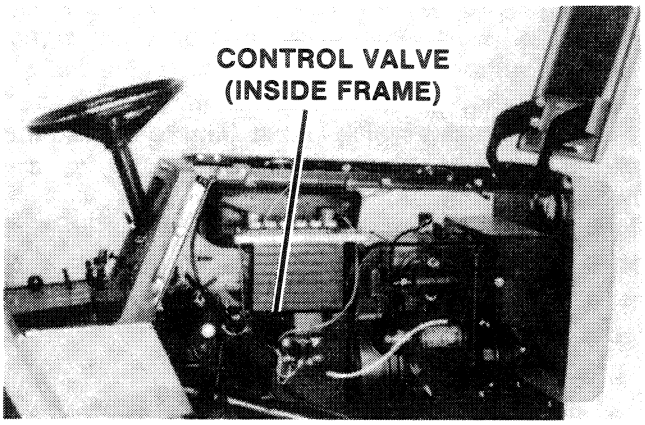


Figure 2 Removal of Control Valve

2. Remove battery, page 74.
3. Clean dirt from around fittings.
4. Disconnect all lines and linkage at valve, *figure 3.*

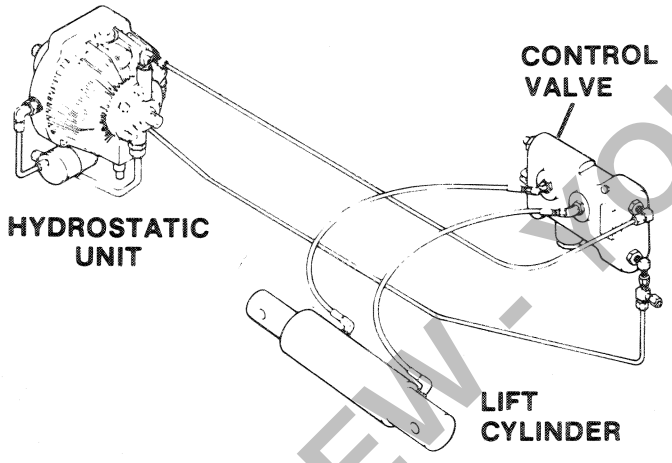


Figure 3 (12, 14 & 16 H.P.)

5. Plug line openings and valve ports to eliminate dirt from entering hydraulic system.
6. Remove (2) capscrews, nuts and lockwashers retaining valve to frame.
7. Remove valve.

DISASSEMBLY (VFP). To disassemble the VFP valve, see procedure for the two spool valve.

DISASSEMBLY (AICO). To disassemble the AICO valve, proceed as follows:

NOTE

Service parts available for AICO and VFP valves are limited to seal kits. Clean outside of valve with a suitable solvent.

1. Remove Spool
   a. Remove end cap, *figure 4.*

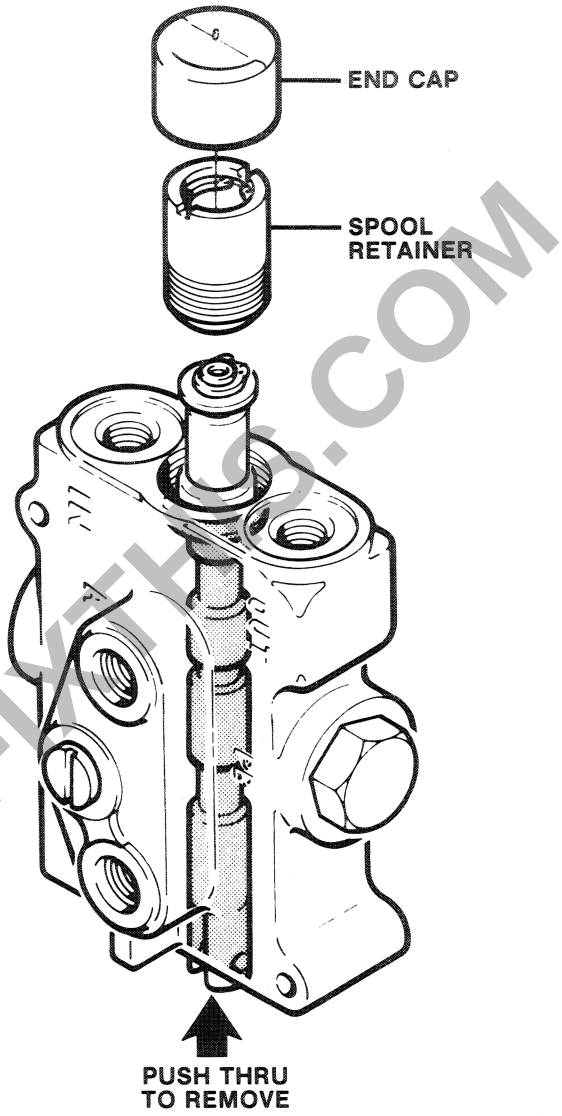


Figure 4 Disassembly AICO Valve (12, 14 & 16 H.P.)

   b. Unscrew and remove spool retainer.
   c. Slide spool back a little to expose the "O" Ring.

NOTE

Extreme care must be used to prevent damaging machined spool surfaces; even a tiny nick will ruin the valve.

   d. Remove retaining ring, back-up washer, and quad-ring from valve body, *figure 5.*
   e. Remove quad-ring and washer.
2. Remove Relief Valve (AICO Valve)
   a. Remove plug and washers, spring, and poppet will drop out, *figure 5.*
   b. Use a broad bladed screw driver to remove seat.

INSPECTION AND REPAIR (AICO VALVE). See procedure for VFP valve.

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TROUBLESHOOTING GUIDE

STARTING SYSTEMS CAUSES						
Problem	Wiring and Connections	Battery	Starter	Neutral-Starter Safety Switches	Solenoid	Key Switch
Starter Fails to Energize	X	X	X	X	X	X
Starter Turns Slowly		X	X			
Starter Spins			X			
Starter Draws High Current			X			

IGNITION SYSTEM CAUSES								
Problem	Wiring and Connections	Spark Plug(s)	Breaker Points	Condenser	Coil	Timing	Battery	Key Switch
Engine Hard to Start	X	X	X	X	X	X	X	
Engine Misfires	X	X	X	X	X	X		X
Engine Backfires	X	X				X		
Engine Knocks or Pings		X				X		
Engine Pre-Ignition		X				X		
Engine Loses Power		X	X	X	X			
Engine Overheating						X		

CHARGING SYSTEM CAUSES						
Problem	Wiring and Connections	Rectifier-Regulator	Stator	Battery	Key Switch	System Overloaded
Battery Uses Excessive Water		X		X		
Battery Discharges Rapidly	X		X	X		X
Battery Remains Discharged	X	X	X	X	X	X
Battery Spewing or Leaking		X		X		
No Alternator Output	X		X			
Unsteady or Low Alternator Output	X		X			
Excessive Alternator Output		X				

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