Bolens®

Service Manual

DuraTrac Tractor

Models

5117H Diesel
(DGT 1800)

5118H
(GT 1800)

5118HS
(GT 1800)

5120H
(GT 2000)

FORM 1760169 (3/92)

TABLE OF CONTENTS

SERIAL NUMBER INFORMATION

To ensure prompt service when repairs or adjustments are required, you must have the following information. For your own personal reference, fill in the following spaces provided.

Model/Serial number of tractor. (Name Plate located on fender under seat).

Engine Model/Serial/Spec Numbers (located on engine).

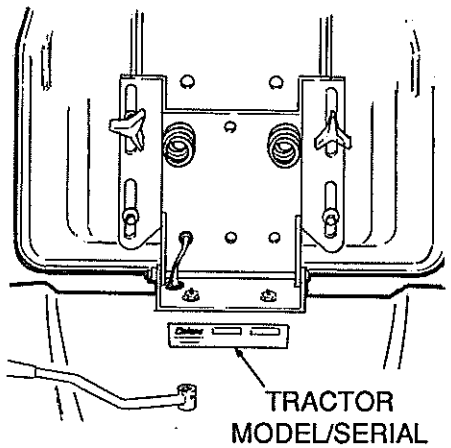


Fig.1-1

CAUTION

WE URGE USING ONLY GENUINE BOLENS REPLACEMENT PARTS, WHICH MEET ALL OF THE LATEST REQUIREMENTS. REPLACEMENT PARTS MANUFACTURED BY OTHERS COULD PRESENT SAFETY HAZARDS EVEN THOUGH THEY MAY FIT ON BOLENS PRODUCTS.

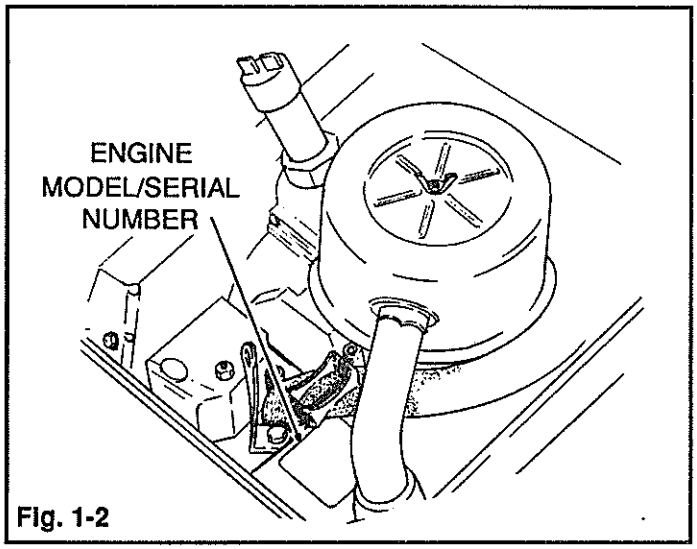


Fig. 1-2

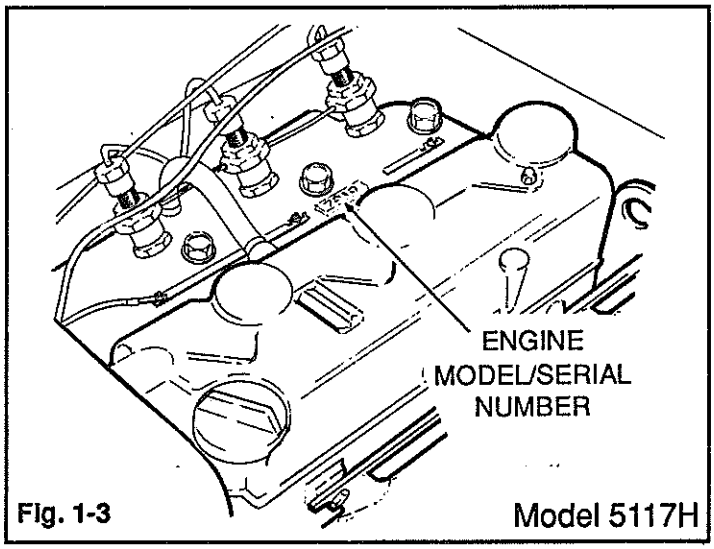


Fig. 1-3 Model 5117H

GENERAL (Continued)

SPECIFICATIONS

Bolens reserves the right to make changes in specification, add improvements or discontinue the manufactured product at any time without notice or obligation.

Illustrations in this manual may not relate exactly to the finished product due to product improvements and running changes.

ENGINE	MODEL 5117H
Manufacturer	Mitsubishi
Model/Spec	L3A-61BG
Type	4 cycle, Water Cooled Diesel
Cylinders	3
Bore and Stroke	2.56" (65 mm) x 2.76" (70 mm)
Piston Displacement	42.48 cu. in. (700 cc)
Firing Order	1-3-2
Fuel Injection Pressure	2000 P.S.I.
Mfr's H.P. Rating	17 H.P at 3600 R.P.M.
Air Cleaner	Paper Element
Oil Capacity	3.8 U.S. Qt. (4.2 liters) w/filter
Governor	Mechanical
Speed Control	Remote, Cable Operated
Starter	Solenoid Shift
Glow Plugs	Sheathed type
Charging System	12V,35 Amp. Alternator
Engine Speed	IDLE-1800 R.P.M. HIGH-3600 R.P.M.
Timing	Shim Injection Pump
Fuel Injection System	Bosch Type
Fuel Transfer Pump	Electric

ENGINE	MODEL 5118H, 5118HS
Manufacturer	Kohler
Model/Spec	M18QS
Type	Horiz. shaft, air cooled 2 cyl., 4 cycle
Bore and Stroke	3.12" (79.4mm) x 2.75" (69.8 mm)
Piston Displacement	42.18 cu. in. (690 cc)
Mfr's H.P. Rating	18 H.P at 3600 R.P.M.
Air Cleaner	Paper Element with Pre-cleaner
Oil Capacity	1.5 U.S. Qts. (1.7 liter) 1.75 U.S. Qts. (1.9 liter) w/filter
Governor	Mechanical
Speed Control	Remote, Cable Operated
Starter	Bendix Type
Charging System	15 Amp. flywheel Alternator
Engine Speed	IDLE-1200 R.P.M. HIGH-3600 R.P.M.
Spark Plug Size	14 mm
Spark Plug	Champion RV15YC
Spark Plug Gap	.025 (0.63 mm)
Ignition	Electronic

ENGINE	MODEL 5120H
Manufacturer	Kohler
Model/Spec	M20QS
Type	Horiz. shaft, air cooled 2 cyl., 4 cycle
Bore and Stroke	3.12" (79.4mm) x 3.06 (77.7 mm)
Piston Displacement	46.98 cu. in. (769 cc)
Mfr's H.P. Rating	20 H.P at 3600 R.P.M.
Air Cleaner	Paper Element with Pre-cleaner
Oil Capacity	1.5 U.S. Qts. (1.7 liter) 1.75 U.S. Qts. (1.9 liter) w/filter
Governor	Mechanical
Speed Control	Remote, Cable Operated
Starter	Bendix Type
Charging System	15 Amp. flywheel Alternator
Engine Speed	IDLE-1200 R.P.M. HIGH-3600 R.P.M.
Spark Plug Size	14 mm
Spark Plug	Champion RV15YC
Spark Plug Gap	.025 (0.63 mm)
Ignition	Electronic

CHASSIS SPECIFICATIONS
MODELS 5117, 5118 and 5120

Type	Steel, Formed Frame
Length	76-3/4 in. (195 cm)
Width	38-1/2 in. (97.8 cm)
Height	47-3/4 in. (121.3 cm)
Wheel Base	49 in. (124 cm)
Turning Radius	34.5 in. (87.5 cm)
Ground Clearance	6-1/2 in. (16.5 cm)
Shipping Weight	5117 1026 lbs./(465kg.) 5118 925 lbs./(419 kg.) 5120 976 lbs./(443 kg.)
PTO Type	Electric Clutch
Transmission	5118-Model 11 Eaton w/single speed rear axle 5117 & 5120-Model 11 Eaton w/two speed rear axle
Transmission Oil Capacity	8 Qts. (7.6 liter)
Speeds 5118	Infinitely variable Forward: 0-6.8 mph (0-10 km/hr) Reverse: 0-2.9 mph (0-4.8 km/hr)
Speeds 5117 & 5120	Infinitely variable Forward: LO 0-3.3 mph(0-5.3 km/hr) HI 0-9.0 mph(0-14.5 km/hr) Reverse: LO 0-1.5 mph(0-2.4 km/hr) HI 0-4.3 mph(0-6.9km/hr)
Brake	Transmission mounted Disc
Tires	Front: 16/6.50-8 Rear: 23/10.50-12
Hydraulics	5118-Single Spool 5117 & 5120-Dual Spool

GENERAL (Continued)

MAINTENANCE CHART
MODELS 5118H, 5118HS & 5120H

DAILY	Engine (Refer to engine manual, "MAINTENANCE PROCEDURES")	As Required
	Cooling Fins (Engine)	Clean
	Transmission Cooling Fins	Clean
	Transmission Oil	Check
	Engine Oil Level	Check
	Engine Cooling Air Screen	Brush Clean
	Tires	Check for wear and Air pressure
First 5 Hrs. to 50 Hrs.	Engine Air Cleaner	Clean Pre-Cleaner Shake out Dirt
	Engine Oil and Filter	Change
	Valve Clearance	Adjust
	Brake	Check for wear and Adjustment
	Engine idle	Adjust
	Transmission Oil Filter	Change--Add Oil to Operating Level
	Battery	Check water level Add as Required
	Belts	Check for wear
Every 100 Hrs.	Engine Oil	Change
	Oil Filter	Replace
	Transmission Oil and Filter	Change
	Air Precleaner Filter	Check
	Spark Plugs	Replace
	Transmission Oil Filter	Replace
	Engine Air Cleaner	Replace Element
	Attachment Drive Clutch	Check and Adjust Clearance
	Fuel filter	Replace
Every 400 Hrs.	Valve Clearance	Adjust**
	Engine idle	Adjust**
	Starter	Inspect**

*More often under extreme conditions.

**Refer to engine manual for technical specifications.

MAINTENANCE CHART
MODEL 5117H

DAILY	Engine (Refer to engine manual, "MAINTENANCE PROCEDURES") ..... As Required Radiator Coolant ..... Check Transmission Cooling Fins ..... Clean Transmission Oil ..... Check Engine Oil Level ..... Check Fan Belt Tightness or Damage ..... Check Radiator Grass Screen ..... Clean Tires ..... Check for wear and Air pressure Brake ..... Check for wear and Adjustment
First 5 Hrs. 50 Hrs.	Transmission Oil Filter ..... Replace Engine Oil and Filter ..... Change Valve Clearance ..... Adjust* Engine idle ..... Adjust* Battery ..... Check water level Add as Required
Every 100 Hrs.	Engine Oil and Filter ..... Change Transmission Oil and Filter ..... Change Air Cleaner Filter ..... Check Fuel Filter ..... Check
Every 400 Hrs.	Valve Clearance ..... Adjust* Engine idle ..... Adjust* Injection Nozzles ..... Inspect* Starter and Alternator ..... Inspect* Glow Plugs ..... Inspect* Engine Coolant (or annually) ..... Replace Air Cleaner Filter ..... Replace** Fuel Filter ..... Replace

*Refer to engine manual supplied for technical specifications.

**More often under extreme conditions.

GENERAL (Continued)

TORQUE VALUES FOR CAP SCREWS

SIZE	 SAE GRADE 2			 SAE GRADE 5			 SAE GRADE 8		
	Lb. In.	Nm	Kgm	Lb. In	Nm	Kgm	Lb. Ins	Nm	Kgm
1/4-20	49	5.5	0.6	75	8.5	0.9	108	12.2	1.2
1/4-28	56	6.3	0.6	86	9.7	1.0	120	13.6	1.4
	Lb. Ft.	Nm	Kgm	Lb. Ft.	Nm	Kgm	Lb. Ft.	Nm	Kgm
5/16-18	8	10.8	1.1	13	17.6	1.8	18	24.4	2.4
5/16-24	9	12.2	1.2	14	18.9	1.9	20	27.1	2.7
3/8-16	15	20.3	2.0	23	31.2	3.1	35	47.4	4.8
3/8-24	17	20.3	2.3	25	33.9	3.4	35	47.4	4.8
7/16-14	24	32.5	3.3	35	47.4	4.8	55	74.5	7.6
7/16-20	25	33.9	3.4	40	54.2	5.5	60	81.3	8.3
1/2-13	35	47.4	4.8	55	74.5	7.6	80	108.4	11.0
1/2-20	40	54.2	5.5	65	88.1	9.0	90	122.0	12.4
9/16-12	55	74.5	7.6	80	108.4	11.0	110	149.1	15.2
9/16-18	60	81.3	8.3	90	122.0	12.4	130	176.2	18.0
5/8-11	75	101.6	10.3	110	149.1	15.2	170	230.4	23.5
5/8-18	85	115.2	11.7	130	176.2	18.0	180	243.9	24.9
3/4-10	130	176.2	18.0	200	271.0	27.7	280	379.4	24.9
3/4-16	145	196.5	20.0	220	298.1	30.4	320	433.6	44.3
7/8-9	125	169.4	17.3	320	433.6	44.3	460	623.3	63.7
7/8-14	140	189.7	19.3	350	474.3	48.4	500	677.5	69.2
1-8	190	257.7	26.3	480	650.4	66.5	680	921.4	94.2
1-12	200	271.0	27.7	530	718.2	73.4	740	1002.7	102.5

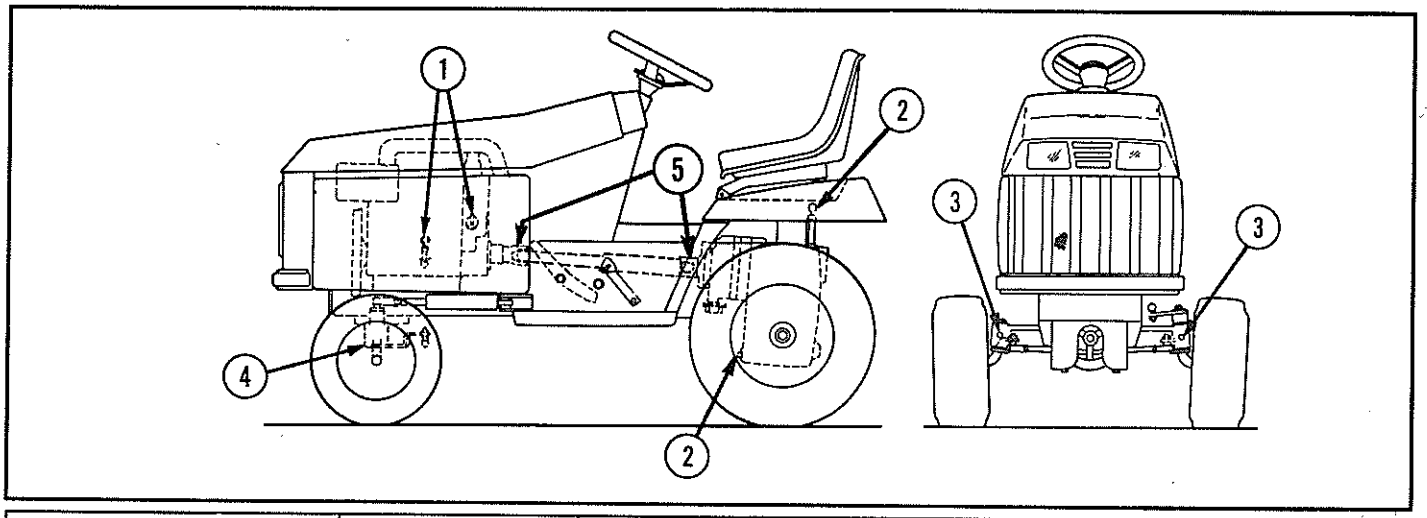
Conversion Formula: To obtain Nm multiply ft. lbs. by 1.355.
To obtain Kgm multiply ft. lbs. by 0.138.

All torques ± 10% unless otherwise specified.
All torque values are for capscrews that have been lubricated with engine oil or grease.

Multiply Standard assembly torque by the following factors:

A. 1.25 when threads are dry
B. 0.85 when parts are plated
C. 0.75 when parts are parkerized
D. 0.70 when parts are coated with Molykote
E. 0.65 for jam nuts

LUBRICATION CHART
HYDROSTATIC DRIVE (MODEL 5117)



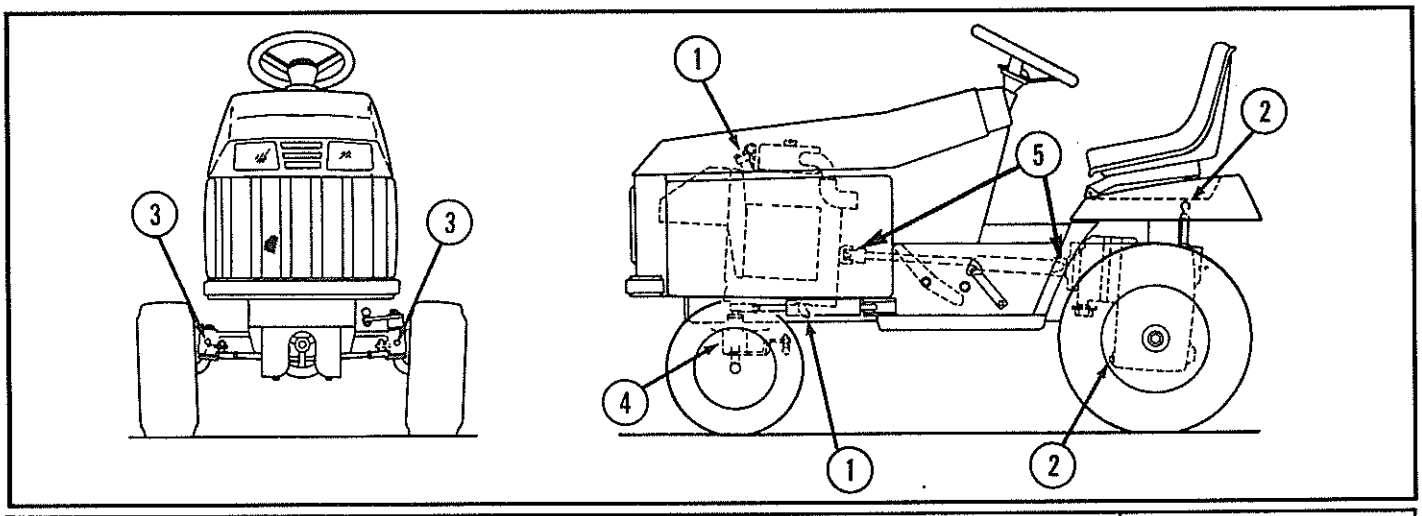
LUBRICATION AREA	LENGTH OF OPERATION	TYPE OF LUBRICATION	AMOUNT REQUIRED
1. ENGINE CRANKCASE	First 50 Hrs. 100 Hours of Operation	High Quality API Oil Class CC or CD **VISCOSITY** ABOVE 68°F (20°C)-SAE 30 or 10W-30 41°F (5°C) to 68°F (20°C)-SAE 20 or 10W-30; Below 41°F (5°C)-SAE 10W-30	3.8 Qts/3.6 L with filter 3.1 Qts/3.0L without filter
2. HYDROSTATIC TRANSMISSION	Check Daily or 10 Hrs. Change when Oil is Discolored, Dirty or After 100 Hrs.	Fill with Bolens Oil Part No. 1738157 (1 Gallon Benzoil Gear Hydraulic Oil) Alternate Fluids: Mobil 423 Amoco 1000 or Texaco TDH	Fill to Within Safety Operating Zone
3. FRONT WHEEL SPINDLES (2)	25 Hrs or End of Each Season	Grease with Multi-Purpose	As Required
4. FRONT AXLE	25 Hrs or End of Each Season	Grease with Multi-Purpose	As Required
5. DRIVE SHAFT	100 Hrs. or Annually	Grease with Multi-Purpose	As Required

NOTE

A hand type grease gun is recommended when greasing your unit. High-pressure type grease guns could cause damage to the fittings and bearing seals. Lubricate all linkages, levers and pins not equipped with grease fittings, with an oil can once a week. Lubricate more often depending on conditions.

GENERAL (Continued)

LUBRICATION CHART
HYDROSTATIC DRIVE (MODEL 5118 & 5120)



LUBRICATION AREA	LENGTH OF OPERATION	TYPE OF LUBRICATION	AMOUNT REQUIRED
1. ENGINE CRANKCASE	First 5 Hrs.	Refer to engine owners manual.	Without Filter 1.5qt. (1.4L) With Filter Add Additional 1/2pt. (0.24L)
	25 Hours AND 50 Hours	Lubrication intervals will change due to type of operation and type of oil used. Refer to engine owners manual.	
2. HYDROSTATIC TRANSMISSION	Check Daily or 10 Hrs.	Fill with Bolens Oil Part No. 1738157 (1 Gallon Benzoil Gear Hydraulic Oil) Alternate Fluids: Mobil 423 Amoco 1000 or Texaco TDH	Fill to Within Safety Operating Zone
	Change when Oil is Discolored, Dirty or After 100 Hrs.		
3. FRONT WHEEL SPINDLES (2)	25 Hrs.or End of Each Season	Grease with Multi-Purpose	As Required
4. FRONT AXLE	25 Hrs.or End of Each Season	Grease with Multi-Purpose	As Required
5. DRIVE SHAFT	100 Hrs. or Annually	Grease with Multi-Purpose	As Required

NOTE

A hand type grease gun is recommended when greasing your unit. High-pressure type grease guns could cause damage to the fittings and bearing seals. Lubricate all linkages, levers and pins not equipped with grease fittings, with an oil can once a week. Lubricate more often depending on conditions.

TROUBLE SHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	REMEDY
Starter Motor does not energize and solenoid does not click.	1. Attachment drive engaged. 2. Brake pedal not depressed. 3. Corroded or loose electrical solenoid connections. 4. Inoperative switches--Attachment drive, brake and key switch. 5. Inoperative solenoid.	1. Disengage Attachment Drive Switch. 2. Depress brake pedal. 3. Clean and tighten Connection at solenoid. 4. Check and replace if necessary. (Refer to switch testing.) 5. Check and replace if necessary. (Refer to solenoid testing.)
Starter Motor does not energize but solenoid clicks.	1. Discharged battery. 2. Corroded or loose electrical connections at battery. 3. Defective solenoid or Starter.	1. Charge battery. 2. Clean & Tighten Connections. 3. Check and replace as necessary.
Engine cranks slowly.	1. Weak or discharged battery. 2. Corroded or loose electrical connections at battery.	1. Check battery, charge or replace if necessary. 2. Clean and tighten.
Battery discharges.	1. Low water level. 2. Defective battery.	1. Check and refill. 2. Check and replace as necessary.
Battery will not charge.	1. Corroded or loose battery cables. 2. Defective battery. 3. Inoperative rectifier/regulator.	1. Clean and tighten. 2. Replace battery. 3. Refer to Engine Manual for test Procedure.

ELECTRICAL SYSTEM (Continued)

TROUBLE SHOOTING GUIDE

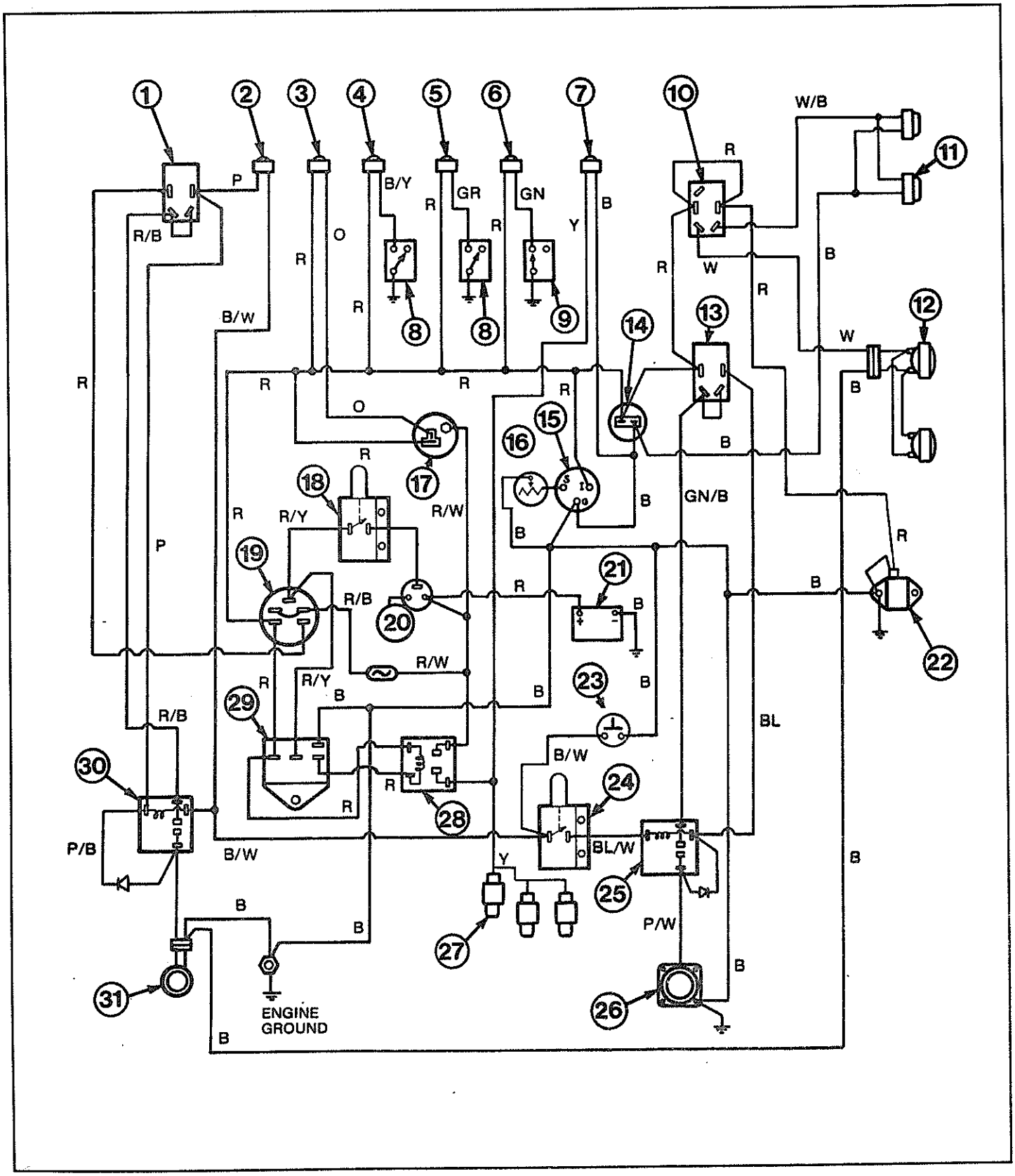
PROBLEM	PROBABLE CAUSE	REMEDY
Lights not operating.	1. Bulbs burned out. 2. Loose or poorly connected white wires or poor black ground wire. 3. Light switch.	1. Replace. 2. Install properly and tighten. 3. Check.
Attachment drive inoperative (Attachment light operative).	1. Broken or loose wires. 2. Electric clutch.	1. Check purple wire between PTO switch and electric clutch. 2. Test, replace
Attachment drive inoperative (Attachment light inoperative).	1. Attachment drive switch. 2. Broken red wire between Attachment drive switch and key switch. 3. PTO relay (5117H Diesel Only).	1. Check and replace if necessary. Refer to Attachment switch test. 2. Check and replace if necessary. 3. Check.
Engine Kills with Operator in Seat.	1. Seat switch Shorted (5118, 5120).	1. Check and replace if necessary. Refer to seat switch test.

ELECTRICAL SYSTEM WIRE COLOR CODE

COLOR	FUNCTION	EXPLANATION
Black	Ground	--
Red Red/White Red/Black Red/Yellow	Switched 12 Volts Unfused, 12 volts Fused, 12 Volts Start Circuit	"Run" or "On" Key Position 12 Volts start position only
Blue Blue/Black	Stop Circuit Safety Interlock	From engine magneto circuit Accessory Stop circuit
White	Lights	--
Purple	PTO Clutch	--
Green	Temperature	Lead used between sender and indicator
Gray	Oil Pressure	Lead used between sender and indicator

ELECTRICAL SYSTEM (Continued)

COMPLETE WIRING DIAGRAM - MODEL 5117

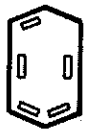


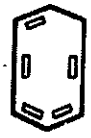
ELECTRICAL SYSTEM (Continued)

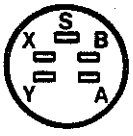
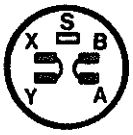
1.....PTO SWITCH
2.....PTO LIGHT
3.....BATTERY LIGHT
4.....WATER TEMP. LIGHT
5.....HYDRO. TEMP. LIGHT
6.....OIL PRESSURE LIGHT
7.....GLOW (PREHEAT) LIGHT
8.....TEMP. SENSOR
9.....PRESSURE SENSOR
10.....LIGHT SWITCH
11.....SIDE LIGHTS
12.....HEADLIGHTS
13.....CRUISE SWITCH
14.....HOUR METER
15.....FUEL GAGE
16.....FUEL SENDER
17.....ALTERNATOR, ENGINE
18.....BRAKE SWITCH
19.....IGNITION SWITCH
20.....STARTER
21.....BATTERY
22.....FUEL PUMP
23.....SEAT SWITCH
24.....CRUISE SWITCH
25.....CRUISE RELAY
26.....CRUISE MAGNET
27.....GLOW PLUGS
28.....GLOW RELAY
29.....GLOW TIMER
30.....PTO RELAY
31.....PTO CLUTCH

COLOR CODE	
B - BLACK	BL - BLUE
O - ORANGE	B/Y - BLACK/YELLOW
P - PURPLE	R/B - RED/BLACK
R - RED	R/W - RED/WHITE
W - WHITE	P/B - PURPLE/BLACK
Y - YELLOW	W/B - WHITE/BLACK
BR - BROWN	R/Y - RED/YELLOW
GR - GRAY	GN/B - GREEN/BLACK
GN - GREEN	

MODEL 5117H

REAR VIEW OF LIGHT SWITCH		
		
OFF	ON SIDE AND HEADLIGHTS	ON HEADLIGHTS

REAR VIEW OF CRUISE AND ATTACHMENT DRIVE SWITCH		
		
OFF	ON	RESET

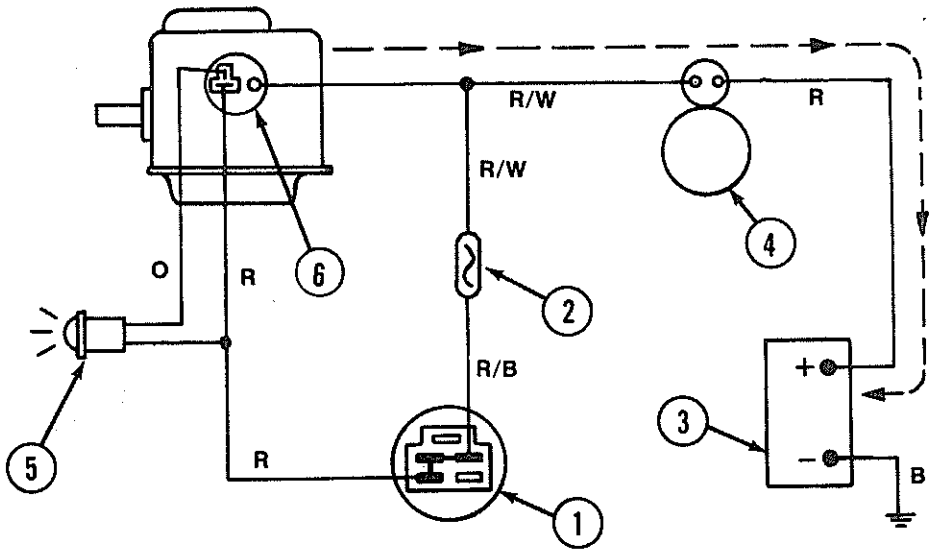
REAR VIEW OF IGNITION SWITCH		
		
OFF	WARM/RUN	START
	X-Y B-A	X-Y B-S

ELECTRICAL SYSTEM (Continued)

CIRCUIT DIAGRAM

CHARGING CIRCUIT

5117 (S/N 0100101 & Later)



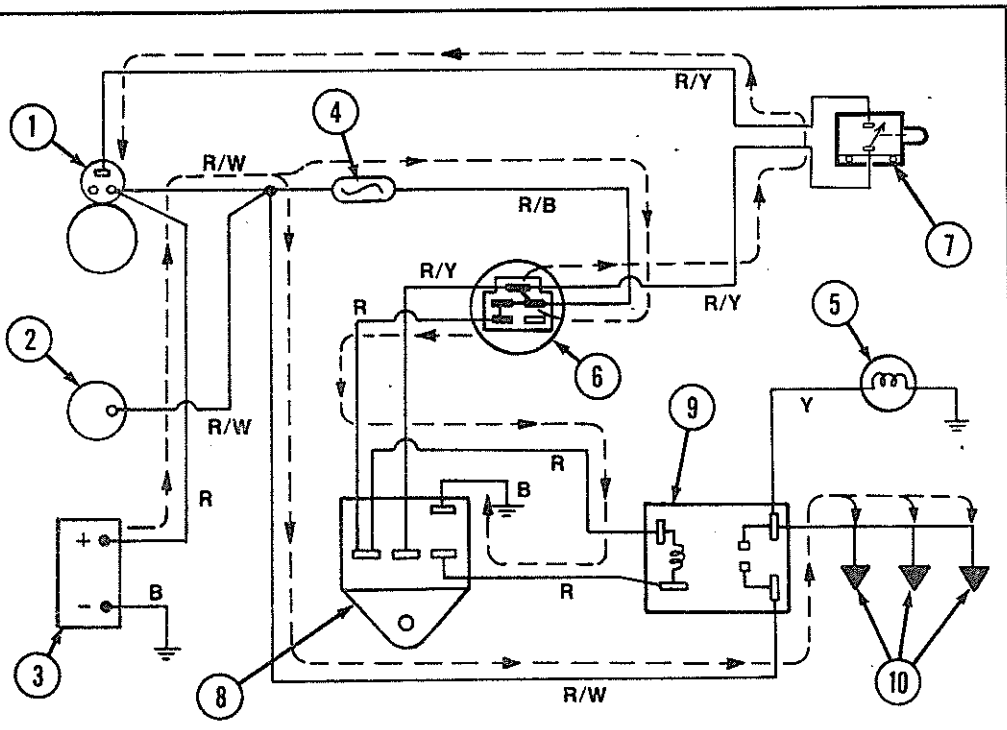
1. IGNITION SWITCH (RUN)
2. FUSE
3. BATTERY
4. SOLENOID AND STARTER
5. BATTERY LIGHT
6. VOLTAGE SENSOR

COLOR CODES

R - RED
B - BLACK
R/B - RED/BLACK
R/W - RED/WHITE
O - ORANGE

Internal Wire Connection

5117 AUTO HEAT / START CIRCUIT



1. STARTER / SOLENOID
2. ALTERNATOR
3. BATTERY
4. FUSE
5. HEAT LIGHT
6. IGNITION SWITCH
7. BRAKE INTERLOCK
8. GLOWTIMER
9. GLOW RELAY
10. GLOW PLUGS

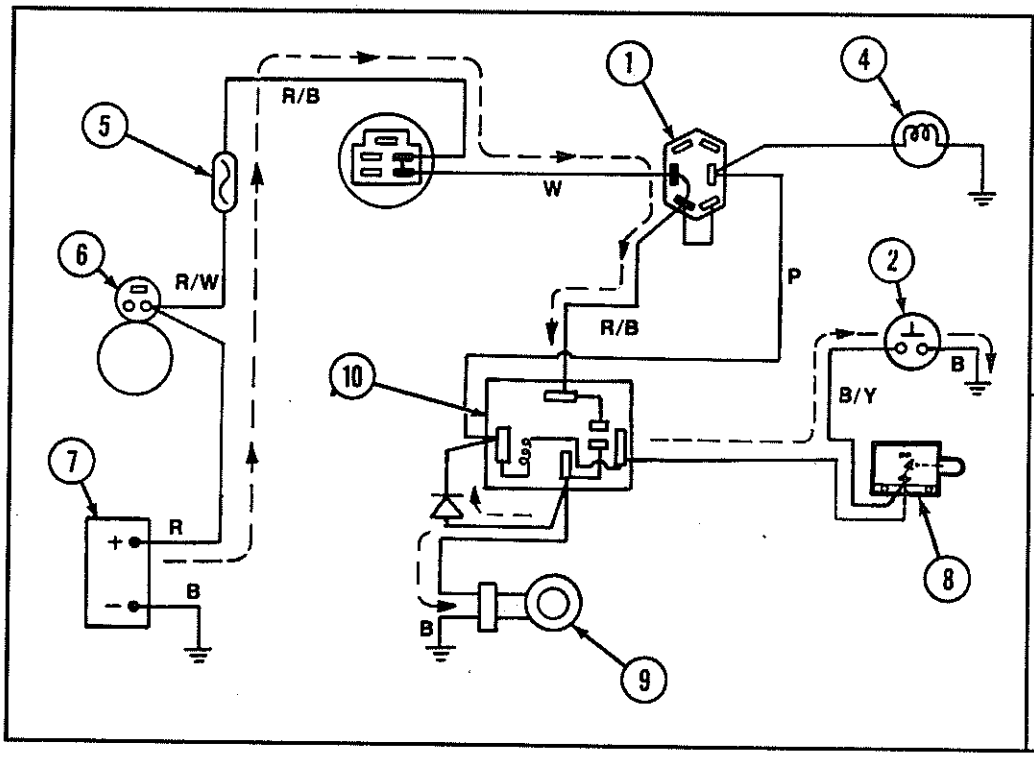
COLOR CODES

R - RED
B - BLACK
R/B - RED/BLACK
R/W - RED/WHITE
Y - YELLOW
R/Y - RED / YELLOW

Internal Wire Connection

CIRCUIT DIAGRAM

5117 SEAT / PTO SWITCH CIRCUIT

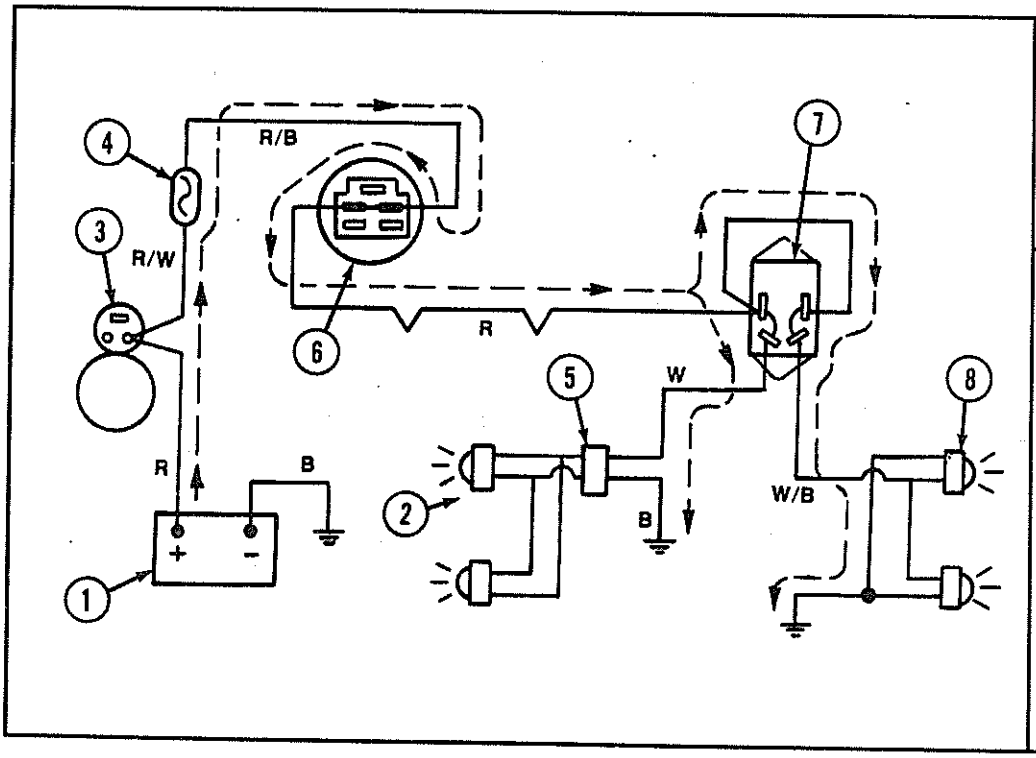


1. ATTACHMENT DRIVE SWITCH (ON)
2. SEAT INTERLOCK SWITCH (NO OPERATOR)
3. IGNITIONS SWITCH (RUN)
4. PTO INDICATOR
5. FUSE
6. SOLENOID / STARTER
7. BATTERY
8. CRUISE INTERLOCK SWITCH
9. PTO CLUTCH
10. GLOW RELAY

COLOR CODES

R	-	RED
B	-	BLACK
R/B	-	RED/BLACK
R/W	-	RED/WHITE
W	-	WHITE
P	-	PURPLE
B/Y	-	BLACK / YELLOW

5117 LIGHT CIRCUIT



1. BATTERY
2. HEATLIGHTS
3. SOLENOID / STARTER
4. FUSE
5. CONNECTOR
6. IGNITION SWITCH (RUN)
7. LIGHT SWITCH (ON)
8. SIDE LIGHTS

COLOR CODES

R	-	RED
W	-	WHITE
B	-	BLACK
R/B	-	RED/BLACK
R/W	-	RED/WHITE
W/B	-	WHITE / BLACK

Terminal Wire Junction

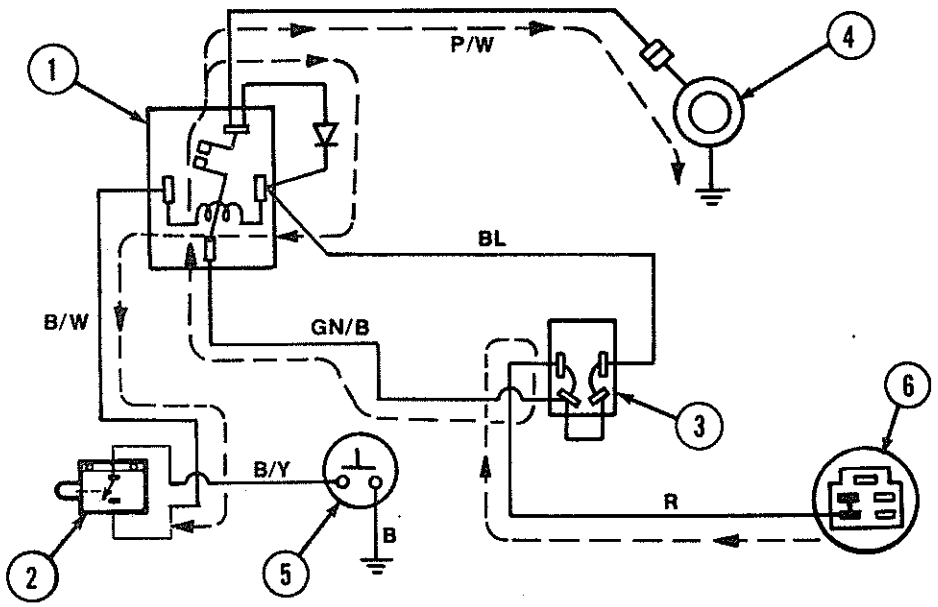
Internal Wire Connection

ELECTRICAL SYSTEM (Continued)

CIRCUIT DIAGRAMS

ELECTRIC CRUISE CIRCUIT

5117 CIRCUIT WITH SWITCH IN "ON" POSITION (AFTER RESET)



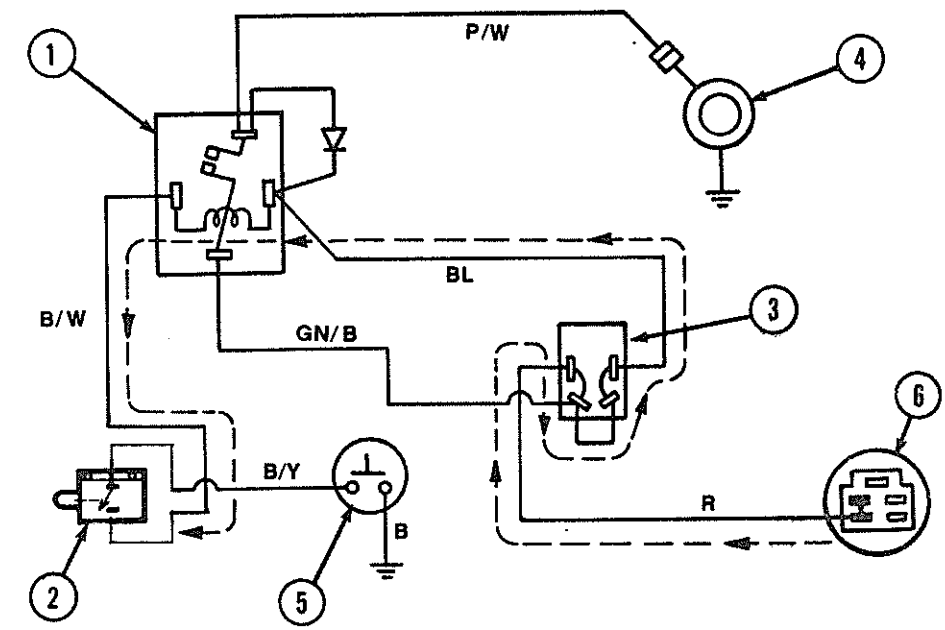
1. RELAY
2. INTERLOCK SWITCH (ON)
3. CRUISE SWITCH (RESET)
4. CRUISE CLUTCH
5. SEAT SWITCH (NO OPERATOR)
6. IGNITION SWITCH (RUN)

COLOR CODES

R	-	RED
B	-	BLACK
BL	-	BLUE
GN/B	-	GREEN / BLACK
B/Y	-	BLACK / YELLOW

ELECTRIC CRUISE CIRCUIT

5117 CIRCUIT WITH SWITCH IN "RESET" POSITION (AFTER RESET)

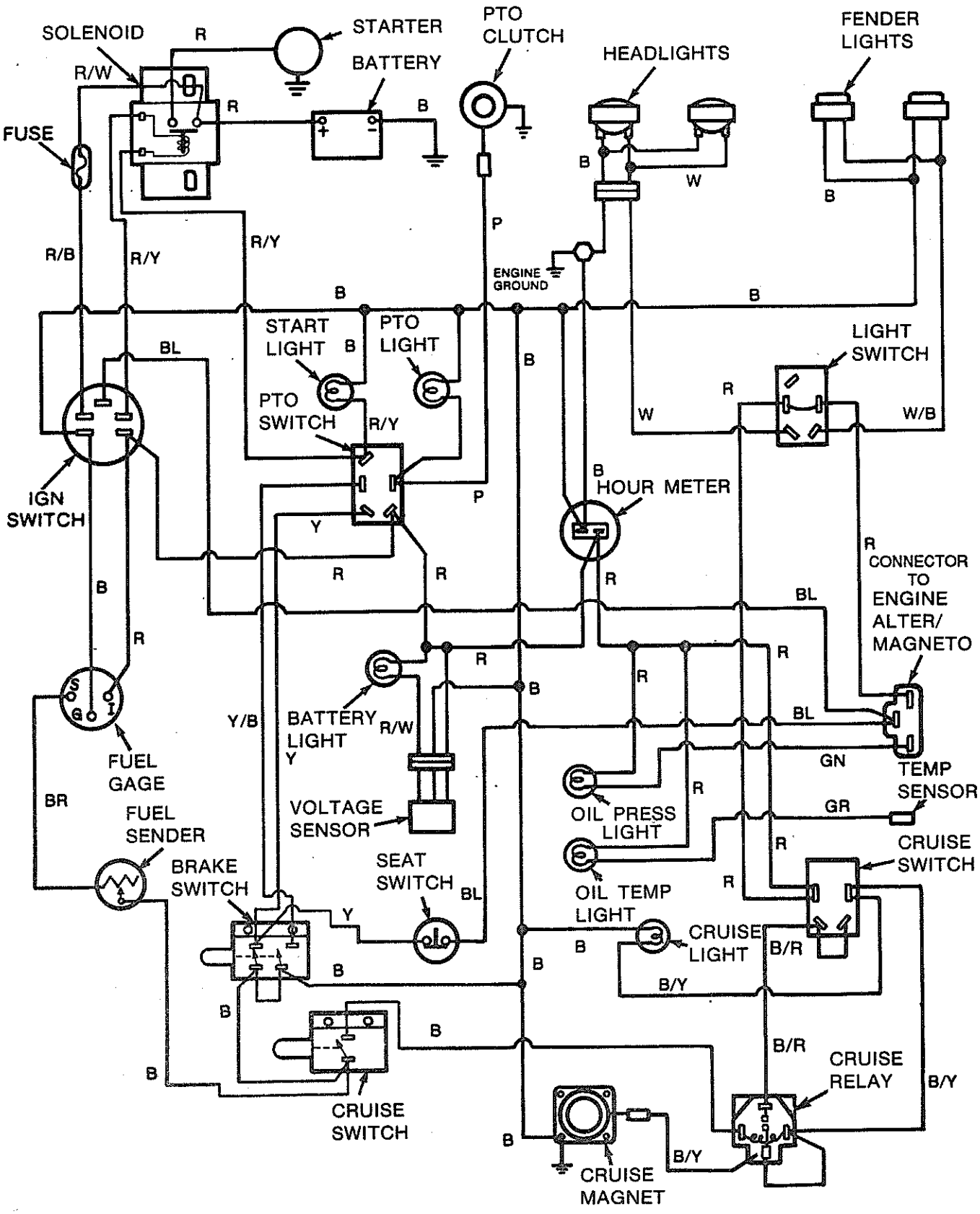


1. RELAY
2. INTERLOCK SWITCH (ON)
3. CRUISE SWITCH (ON)
4. CRUISE CLUTCH
5. SEAT SWITCH (NO OPERATOR)
6. IGNITION SWITCH (RUN)

NOTES

ELECTRICAL SYSTEM (Continued)

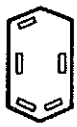
COMPLETE WIRING DIAGRAM - MODEL 5118 AND 5120

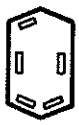


MODEL 5118H & 5118HS AND 5120H (Gas Engines)

COLOR CODE	
B	BLACK
P	PURPLE
R	RED
W	WHITE
Y	YELLOW
BR	BROWN
GR	GRAY
GN	GREEN
BL	BLUE
B/Y	BLACK / YELLOW
R/B	RED / BLACK
W/B	WHITE / BLACK
P/B	PURPLE / BLACK
W/B	WHITE / BLACK
R/Y	RED / YELLOW
B/R	BLACK / RED

REAR VIEW OF ATTACHMENT DRIVE SWITCH	
	
OFF	ON

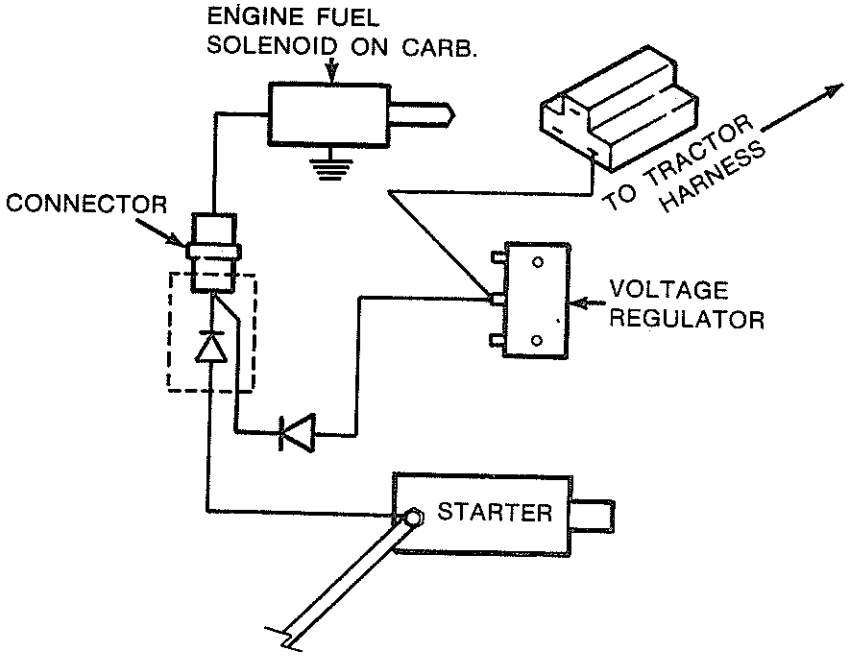
REAR VIEW OF CRUISE SWITCH		
		
OFF	ON	RESET

REAR VIEW OF LIGHT SWITCH		
		
OFF	ON SIDE AND HEADLIGHTS	ON HEADLIGHTS

REAR VIEW OF IGNITION SWITCH		
		
OFF	RUN	START
G-M	B-R	B-S

Fuel Shut-off Solenoid And Harness Suppled with Kohler Engine

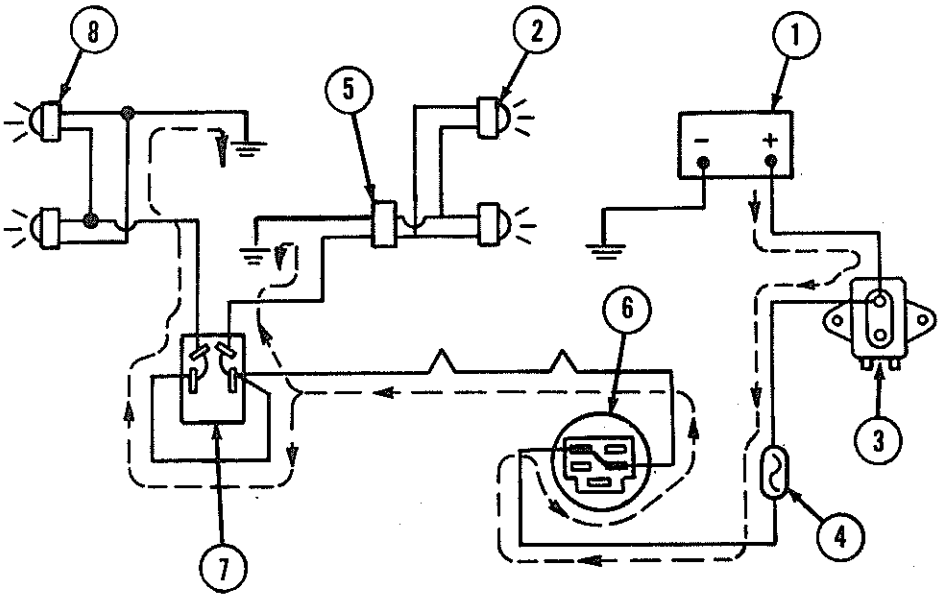
PURCHASE
PARTS FROM KOHLER



ELECTRICAL SYSTEM (Continued)

CIRCUIT DIAGRAMS

5118 & 5120 LIGHT CIRCUIT



1. BATTERY
2. HEADLIGHTS
3. SOLENOID
4. FUSE
5. CONNECTOR
6. IGNITION SWITCH (RUN)
7. LIGHT SWITCH
8. SIDE LIGHTS

COLOR CODES

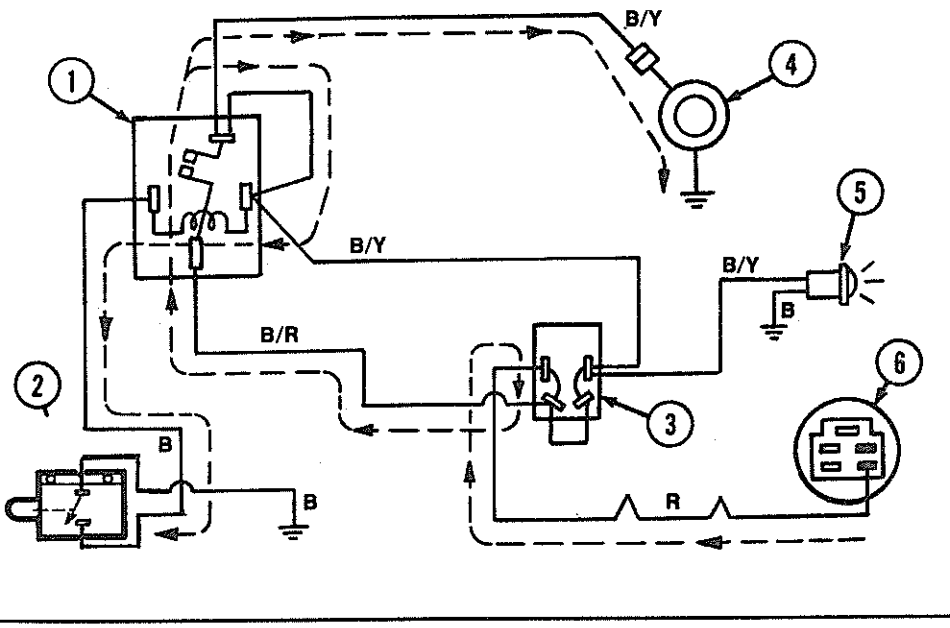
R - RED
B - BLACK
W - WHITE
R/B - RED / BLACK
R/W - RED / WHITE
W/B - WHITE / BLACK

Terminal Wire Junction

Internal Wire Connection

ELECTRIC CRUISE CIRCUIT

5118, 5120 CIRCUIT WITH RELAY IN "ON" POSITION (AFTER RESET)



1. RELAY
2. INTERLOCK SWITCH (ON)
3. CRUISE SWITCH (ON)
4. CRUISE CLUTCH
5. CRUISE LIGHT
6. IGNITION SWITCH (RUN)

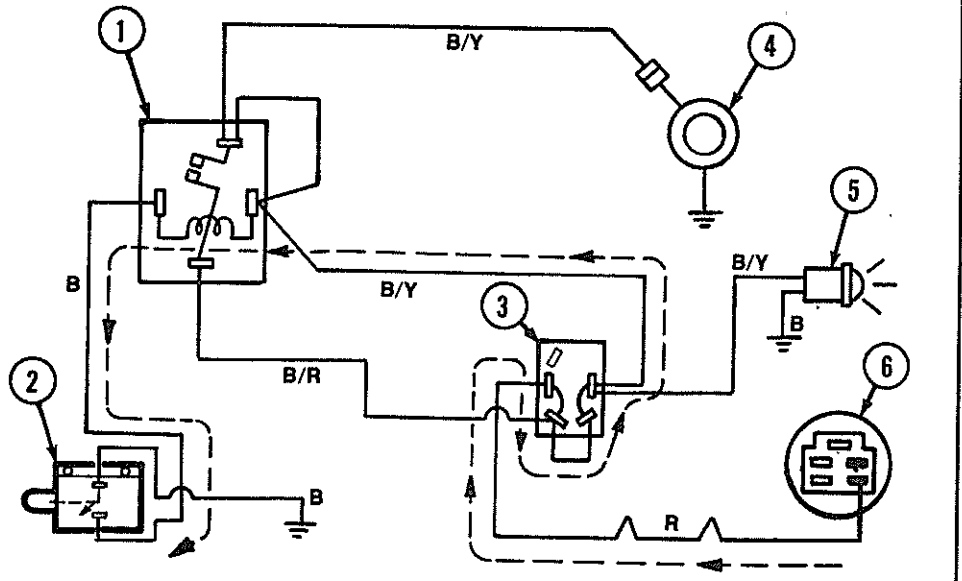
COLOR CODES

B - BLACK
R - RED
B/R - BLACK / RED
B/Y - BLACK / YELLOW

CIRCUIT DIAGRAM

ELECTRIC CRUISE CIRCUIT

5118, 5120 CIRCUIT WITH RELAY IN "RESET" POSITION



1. RELAY
2. BRAKE INTERLOCK SWITCH (ON)
3. CRUISE SWITCH (ON)
4. CRUISE CLUTCH
5. CRUISE LIGHT
6. IGNITION SWITCH (RUN)

COLOR CODES

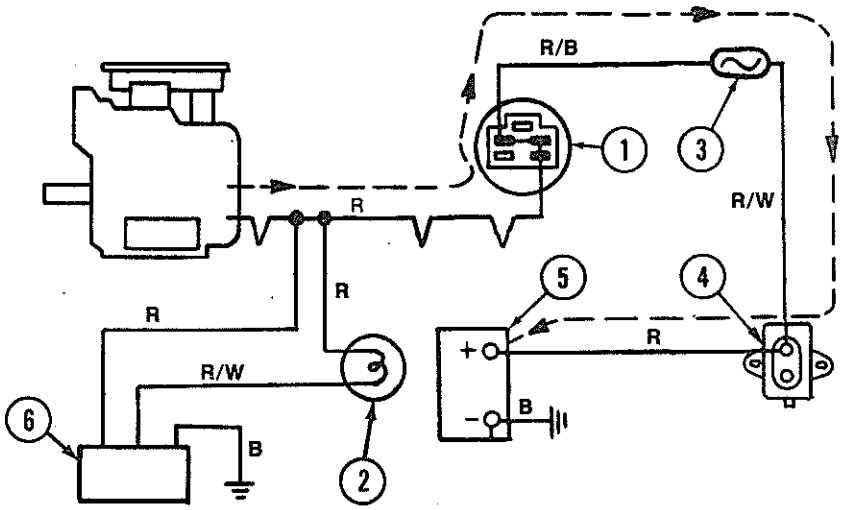
B - BLACK
R - RED
B/R - BLACK / RED
B/Y - BLACK / YELLOW

ELECTRICAL SYSTEM (Continued)

CIRCUIT DIAGRAMS

CHARGING CIRCUIT

5118, 5120 (S/N 0100101 & Later)



1. IGNITION SWITCH (RUN)
2. BATTERY VOLT INDICATOR
3. FUSE
4. SOLENOID
5. BATTERY
6. VOLTAGE SENSOR

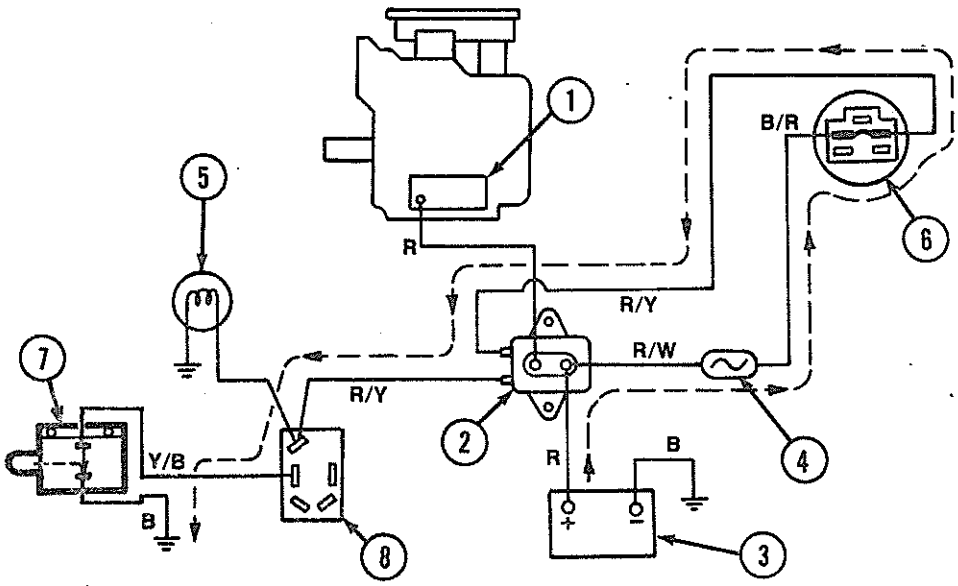
COLOR CODES

R - RED
B - BLACK
R/B - RED / BLACK
R/W - RED WHITE

Terminal Wire Junction

Internal Wire Connection

5118, 5120 START CIRCUIT



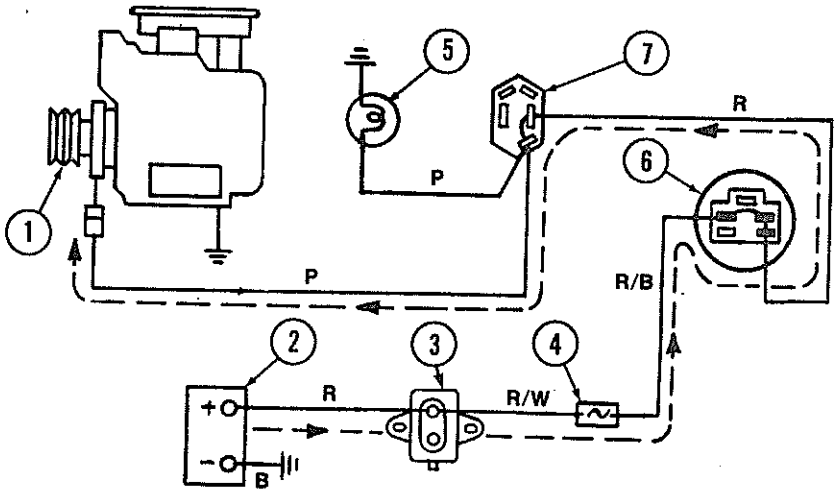
1. STARTER
2. SOLENOID
3. BATTERY
4. FUSE
5. IGNITION LIGHT
6. IGNITION SWITCH
7. BRAKE INTERLOCK SWITCH (OFF)
8. PTO SWITCH (OFF)

COLOR CODES

R - RED
B - BLACK
R/B - RED/BLACK
R/W - RED/WHITE
R/Y - RED / YELLOW
Y/B - YELLOW / BLACK

CIRCUIT DIAGRAMS

5118, 5120 P.T.O. CLUTCH CIRCUIT

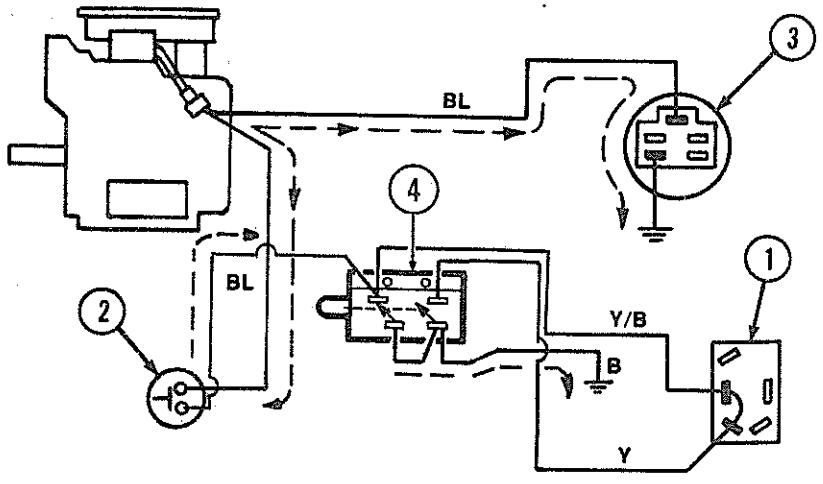


1. PTO CLUTCH
2. BATTERY
3. SOLENOID LIGHT
4. FUSE
5. PTO INDICATOR LIGHT
6. IGNITION SWITCH (RUN)
7. PTO SWITCH (ON)

COLOR CODES

R - RED
B - BLACK
R/B - RED/BLACK
R/W - RED/WHITE
P - PURPLE

5118, 5120 SEAT SWITCH CIRCUIT



1. ATTACHMENT DRIVE SWITCH (ON)
2. SEAT INTERLOCK SWITCH (NO OPERATOR)
3. IGNITION SWITCH (OFF)
4. BRAKE SWITCH (OFF)

COLOR CODES

BL - BLUE
B - BLACK
Y - YELLOW
Y/B - YELLOW / BLACK

ELECTRICAL SYSTEM (Continued)

TESTING ELECTRICAL COMPONENTS

TESTING BATTERY

CHECKING SPECIFIC GRAVITY

To determine whether the battery is capable of meeting the requirements of the starting motor, it is necessary to subject the battery to a load test. The battery must be at least 75% charged for this test. To determine the percentage of charge a hydrometer reading should be taken.

The following table illustrates ranges of specific gravity for each cell in various states of charge at 80° F.

SPECIFIC GRAVITY

	PERCENTAGE CHARGED
1.250 to 1.280	100%
1.230 to 1.250	75%
1.200 to 1.220	50%
1.170 to 1.190	25%
1.140 to 1.160	10%
1.110 to 1.130	DISCHARGED

CHECKING BATTERY VOLTAGE

Battery voltage can be checked with a volt-ohm meter and should be between 11.5 and 12.5 volts.

BATTERY CRANKING TEST

For this test the battery should be approximately 80°F.

1. Check battery electrolyte level, add water if necessary. Battery must be fully charged.
2. Check battery voltage. It should be between 11.5 and 12.5 volts.
3. Crank the engine using the starter motor for 15 seconds. Battery voltage should not drop below 9.0 volts at the end of this 15 second test.
4. If voltage is less than 9.0 volts, repeat step 1 through 4. If the same results are obtained, replace the battery.

SOLENOID TEST

CAUTION

IF A BATTERY IS THE 12 VOLT POWER SOURCE, DO NOT ALLOW A SPARK OR FLAME NEAR THE BATTERY. ELECTRIC STORAGE BATTERIES CAN GIVE OFF HIGHLY FLAMMABLE GAS WHICH CAN IGNITE AND CAUSE AN EXPLOSION.

The solenoid is a sealed unit and must be replaced if found inoperative.

To test the solenoid, connect 12 volts between the first small terminal (A) and the solenoid case (B). If solenoid has 2 small terminals, connect 12 volts between the terminals, (A and C, Fig. 2-1). When contact is made the plunger should be activated and resistance between large terminals D & E should be 0 ohms. If test does not activate the plunger or the resistance between D &E is infinite (∞)ohms, replacement is necessary.

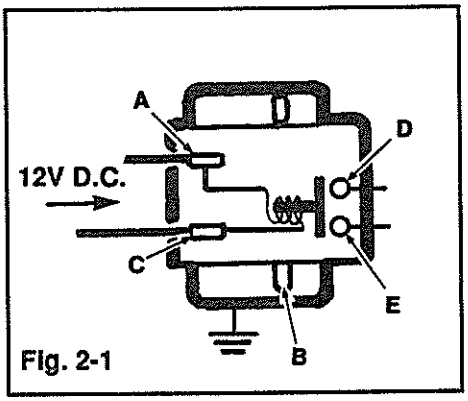


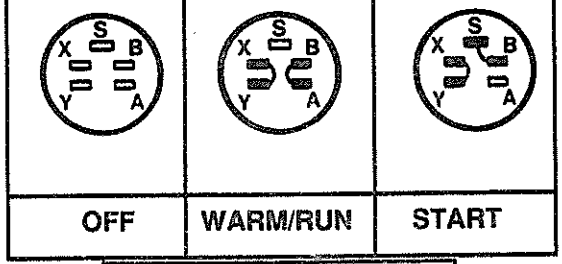
Fig. 2-1

IGNITION SWITCH TEST

Test the ignition switch for proper internal connections using an ohm meter of continuity light. Terminal should be closed only in positions indicated.

Model 5117H

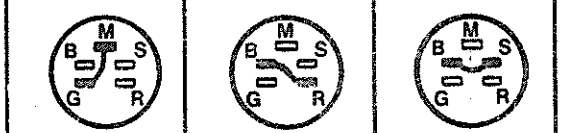
REAR VIEW OF IGNITION SWITCH



OFF	WARM/RUN	START

Models 5118H, 5118HS & 5120H

REAR VIEW OF IGNITION SWITCH



OFF	RUN	START

TESTING ELECTRICAL SYSTEM

Before electrical tests of these switches are made, make sure mechanical adjustements of the acutating mechanisms are correct.

BRAKE/START AND BRAKE/CRUISE SWITCHES

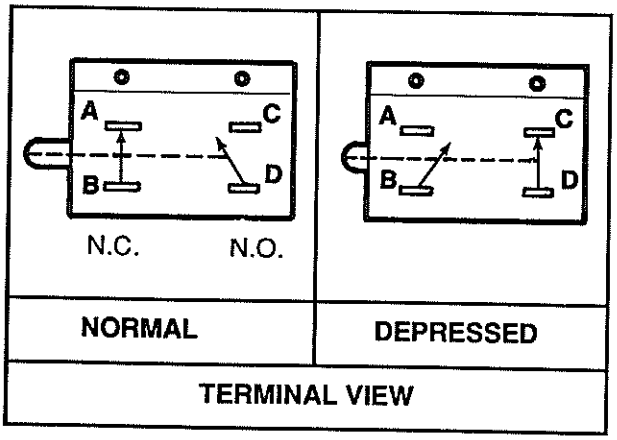
To test switch, connect an ohm meter between the C and D terminals (See below) and depress plunger. Meter should indicate open (infinite resistance) to closed (zero resistance).

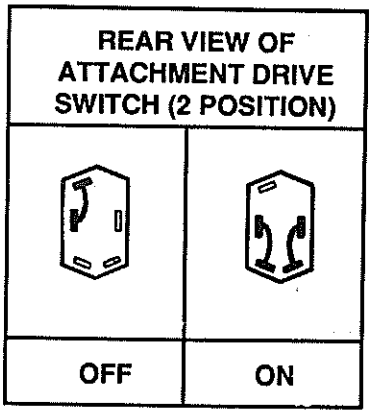
Connect the meter between the A and B terminals, and deperess the plunger. The meter should switch from closed (zero resistance) to open (infinite resistance).

ATTACHMENT DRIVE SWITCH
When switch is in the down (OFF) position, check continuity between the middle terminal and top terminals. Resistance should be zero.

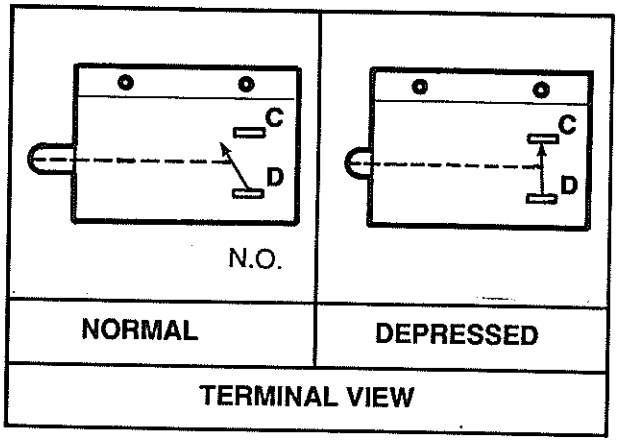
When switch is in the up (ON) position, check continuity between the middle and bottom terminals. Resistance should be zero. Check both halves of the switch.

BRAKE/START SWITCH





BRAKE/CRUISE SWITCH



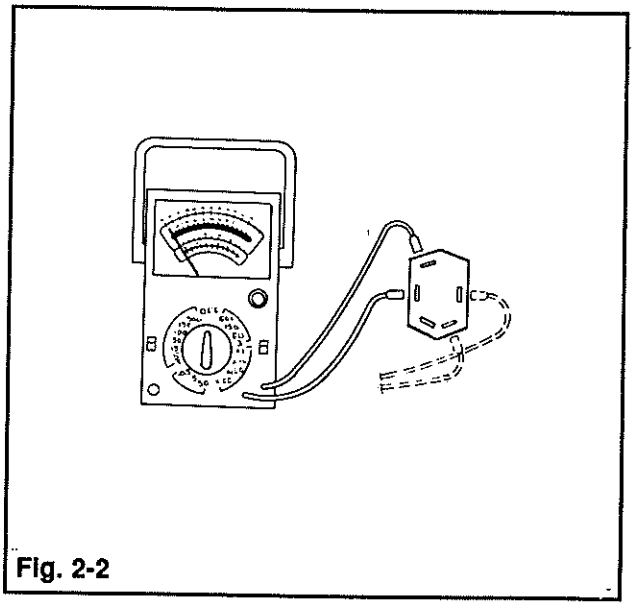


Fig. 2-2

ELECTRICAL SYSTEM (Continued)

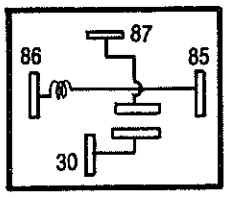
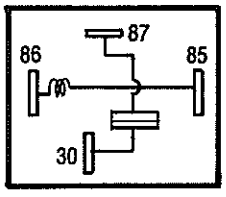
TESTING ELECTRICAL SYSTEM

RELAY TESTS

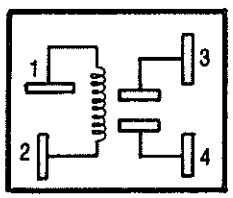
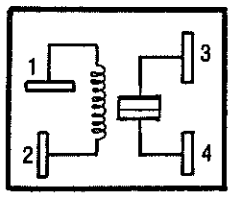
By applying 12 volts D.C. to the coil terminals (85 or 86 or 1 and 2) the "normally open" contacts (30 and 87 or 3 or 4) should "close". Removing the 12 volts should "open" the contacts.

Removing the 12 Volts should open the contacts (infinite (∞) resistance of checked with an ohm meter).

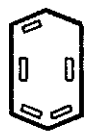
CRUISE/PTO RELAY

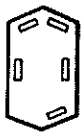
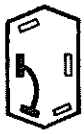
	
(NORMALLY OPEN CONTACTS, 87 & 30) (COIL 85 & 86 [70 OHMS])	(12 VOLTS APPLIED TO 86 & 85) (CONTACTS 87 & 30 CLOSED)
TERMINAL VIEW	

GLOW RELAY

	
(NORMALLY OPEN CONTACTS, 1 & 2) (COIL 3 & 4 [13 OHMS])	(12 VOLTS APPLIED TO ~~3 & 4~~ 1 + 2 (CONTACTS ~~87 & 30~~ 3+4 CLOSED)
TERMINAL VIEW	

The following switches are tested in a manner similiar to the switches on the preceding page. They should show continuity (zero resistance) between the highlighted terminals.

3 POSITION CRUISE OR PTO SWITCH		
		
OFF	ON	RESET

3 POSITION LIGHT SWITCH		
		
OFF	ON SIDE AND HEADLIGHTS	ON HEADLIGHTS

TESTING ELECTRICAL SYSTEM

DIODE TEST

A continuity light or ohm meter can be used to check diodes. If a continuity light is used, connect across the diode, note wether light comes on, then reverse leads. The light should be on in one case but not the other when the leads are reversed.

If an ohm meter is used, measure the resistance, then, reverse leads and re-measure. A ten-to-one resistance ratio should be measured.

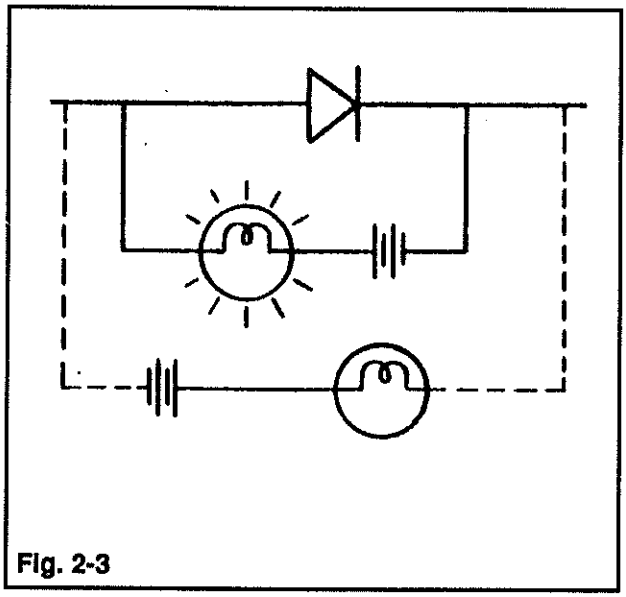


Fig. 2-3

TROUBLE SHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	REMEDY
No forward or reverse with engine running.	1. 2-Speed in Neutral (5117, 5120).	1. Shift into High or Low Gear.
	2. System low on oil.	2. Refill to proper level.
	3. Plugged oil filter.	3. Replace filter.
	4. Control linkage binding.	4. Check linkage for binding; lubricate.
	5. Hydro unit not functioning.	5. Test hydro pressure. See pg 6-5.
Loss of power.	1. Filter or suction line clogged.	1. Replace filter, clean and re-fill system.
	2. Low on oil.	2. Check and add as necessary.
	3. Worn or loose hydro linkage.	3. Adjust or replace.
	4. Air in system.	4. Check for leaks and re-fill.
	5. Engine lugs down.	5. Check engine for proper RPM adjustments.
	6. Internal Wear on Hydro.	6. Test hydro pressure. See Pg. 6-5.
Unit operating hot.	1. Oil level low.	1. Check for leaks and re-fill to proper level.
	2. Dirt on transmission fins.	2. Clean external surfaces.
	3. Excessive load or high drawbar loading.	3. Reduce load.
	4. Partially plugged filter.	4. Replace filter and transmission fluid.
	5. Fan missing or not rotating	5. Repair or replace cooling Fan.
	6. Internal damage to hydro.	6. Replace hydro.
Brake does not function properly.	1. Brake out of adjustment.	1. Check brake adjustment, adjust as necessary.
	2. Worn brake pucks.	2. Replace pucks.

DRIVE TRAIN (Continued)

HYDROSTATIC INTRODUCTION & REPAIR

The Eaton Model 11 hydrostatic transmission is composed of four (4) major components; a charge pump; a variable displacement, radial ball-piston pump; a fixed displacement, radial ball-piston motor; and a system of valves located between the pump and motor.

The transmission converts mechanical energy at its input shaft into fluid flow under pressure from its pump. The transmission then transfers this fluid energy to its motor which in turn converts it back to mechanical energy at its output shaft. The purpose of this transformation is to provide a means of having an infinitely variable output speed, with easy reversing–all with a constant input speed. In operation, the pressure of the fluid in the hydrostatic transmission closed loop varies as the "load" increases or decreases.

If the load increases, so does the pressure of the fluid in the transmission. This change in load and pressure automatically changes the torque output of the transmission.
The greater the load (pressure), the more torque the transmission produces to match the load requirements. If the load is lessened, - pressure decreases and torque output drops.

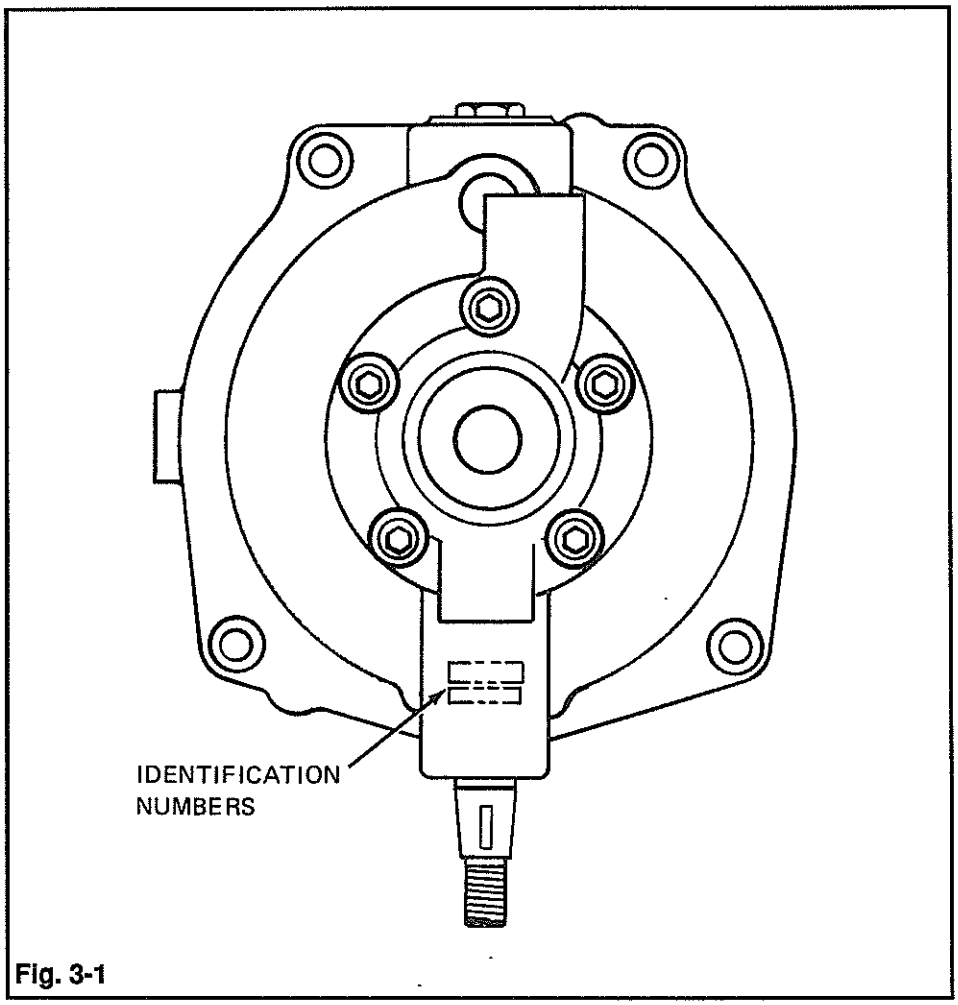


Fig. 3-1

IDENTIFICATION (Fig. 3-1)

A counter-clockwise drive, Model 11 hydrostatic, is used in the 5000 and 5100 Series tractors.

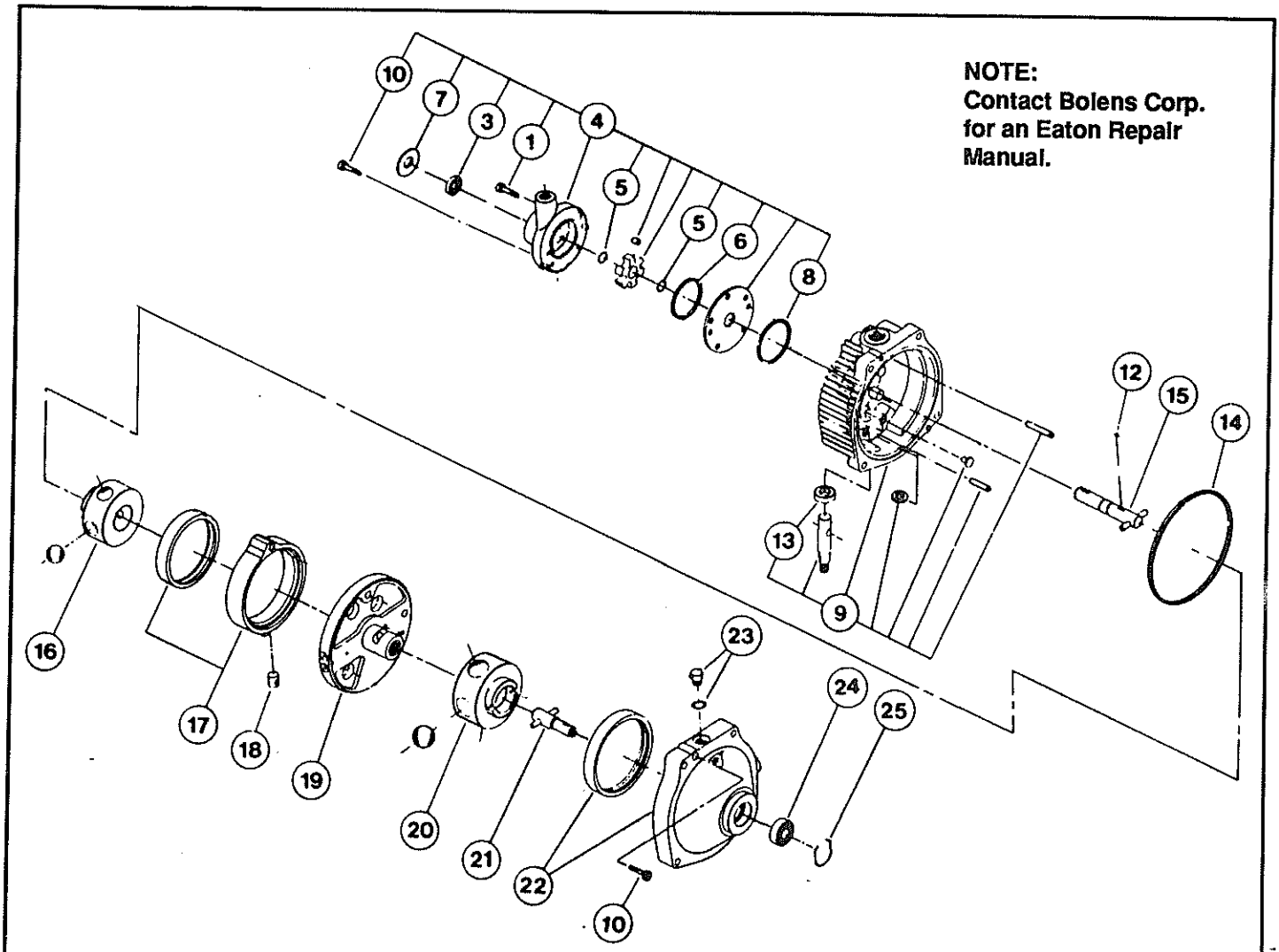
To identify, locate the Serial Number stamped in the specified area.

REPAIR

If the hydrostatic transmission is in need of repair, refer to the Eaton Repair Manual. This manual is available from the your Bolens dealer.

DRIVE TRAIN (Continued)

HYDROSTATIC BREAKDOWN



Ref #	Description	Qty.
1	Socket Screw 5/16-18 x 1-3/4 (Incl. w/Ref. 4.)	1
3	Oil Seal (Incl. w/Ref. 4)	1
4	Charge Pump Kit (Incl. Ref. 1,3,5,6,7,8,10 12)	1
5	Snap Ring (Incl. w/Ref. 4)	1
6	Sq. Seal Ring (Incl. w/Ref. 4)	1
7	Grass Shield (Incl. w/Ref. 4)	1
8	Sq. Seal Ring (Incl. w/Ref. 4)	1
9	Cover Sub Ass'y (Incl. w/Ref. 4)	1
10	Socket Hd. Screw 5/16-18 x 1-1/4 (Incl. w/Ref. 4)	1
12	Drive Pin (Incl. w/Ref. 4)	1
13	Oil Seal (Incl. w/Ref. 9)	1
14	Square Seal Ring	1
15	Input Shaft Sub Ass'y	1
16	Pump Rotor & Ball Ass'y	1
17	Cam Ring Ass'y	1
18	Cam Ring Insert	1
19	Pintle Ass'y (Incl. Internal Parts)	1
20	Motor Rotor & Ball Sub Ass'y	1
21	Output Shaft Sub Ass'y	
22	Body Ass'y (Incl. Ref. 21, 24 & 25)	1
23	O-Ring Plug Sub Ass'y	1
24	Ball Bearing (Output)	1
25	Retaining Ring	1

HYDROSTATIC REMOVAL & RE-INSTALLATION

HYDROSTATIC REMOVAL (Fig. 3-2, 3-3 & 3-4)

1. Remove any center or rear mount attachments and drain oil from the transaxle.

2. Remove four (4) bolts (A, Fig. 3-2) securing tunnel cover (B).

3. Loosen seat (C) at screws and knobs (D). Remove from seat support. Disconnect seat switch wires (E) and remove seat.

4. **(TWO SPEED MODELS)** Remove roll pin (F) from shift lever (G). Remove shift lever.

5. Remove the 2-5/16 Flange Nuts (G) securing rear of fender and the 2-5/16 Flange Bolts (H) securing front of fender. Pull seat switch wires through seat support and fender. Remove fuel cap and lift fender and seat support off.

6. Cut the tie straps holding wire harness to hydraulic tubes (note position of tie straps for assembly).

7. Loosen the six bolts (I, [3 on each side]) that hold the range light panel to the frame. Disconnect the wires from the fuel sending unit and slide the panel forward out of the way.

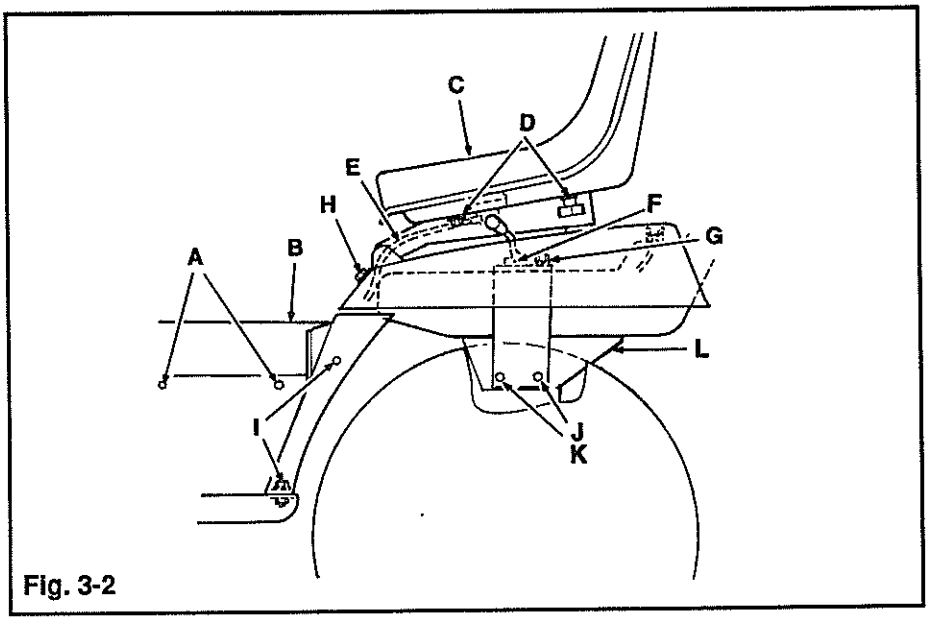


Fig. 3-2

8. Shut the fuel valve off and disconnect the fuel line. Some models are equipped with a clip that holds the line to the frame. Remove the clip–**Older Models** the fuel line is strapped to the frame. Cut the tie-straps (note position of tie-straps for re-assembly).

9. On the Left side of the tank, remove the two (2) lower 3/8 x 1 bolts and flange nuts (J, Fig. 3-2). On the right side, remove the lower two (2) 3/8 flange bolts (K) which are threaded into the rear axle housing (L). Remove fuel tank.

10. Loosen the 2 set screws securing engine driveshaft to transmission input shaft. Slide driveshaft all the way forward and let it rest on the rocker shaft.

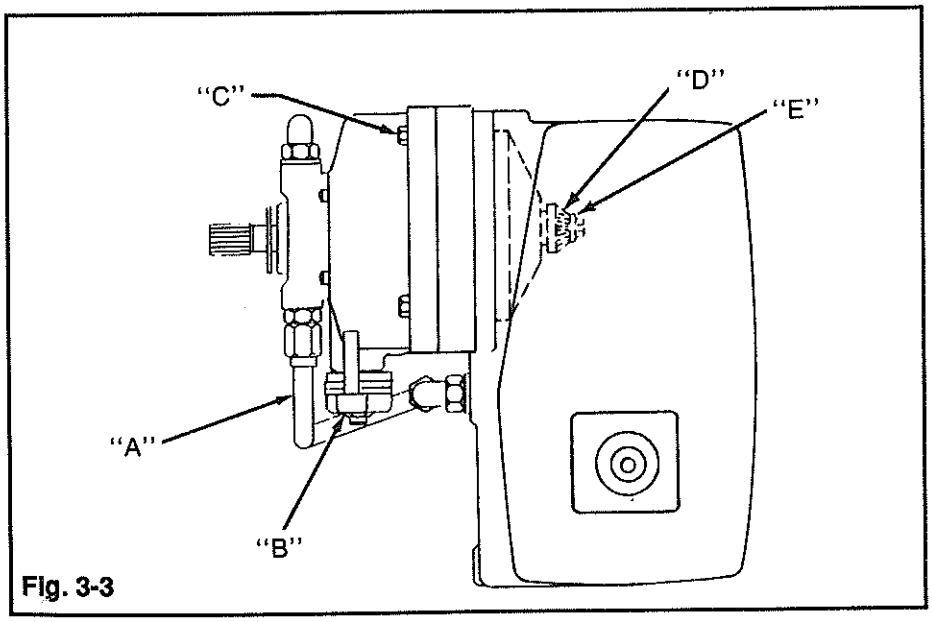


Fig. 3-3

11. Disconnect and remove suction line (A, Fig. 3-3) from bottom of hydro and rear axle, disconnect and remove return line from right side of hydro and filter base. Disconnect pressure line from TOP of hydro (it is not necessary to disconnect the other end of the line).

12. Remove nut and washer on control shaft and slide control arm assembly (B, Fig. 3-3) off of shaft. **NOTE:** A puller may be necessary when removing control arm.

13. Remove four (4) mounting bolts holding hydro to rear axle. It may be necessary to tap on hydro to break it loose from rear axle housing (Fig. 3-4).

HYDROSTATIC REMOVAL & RE-INSTALLATION

14. If the bevel gear on the end of output shaft is going to be removed, note the number of shims between the gear and hydro—the same number must be re-installed during assembly.

HYDROSTATIC REPAIR

If the hydrostatic transmission is in need of repair, refer to the Eaton Service and Repair Manual. This manual is available from the ***Bolens*** factory.

INSTALLATION
(Fig 3-4)

1. Clean the mounting surface (on the hydro and transaxle) of all oil, grease and dirt before re-installing the hydro. Run a thin bead of silicon rubber around the mounting surfaces and around bolt holes (not **in** the bolt holes). Secure with the four (4) capscrews and lockwashers removed earlier (C, Fig.3-4). Coat mounting screws with loctite 242 (or equivalent) and torque them to 24 ft.-lbs. (32.5 N-m) when fastening.

2. Check for pinion to bevel gear backlash using a dial indicator to check the end play of the brake shaft (Z, Fig 3-4), backlash at this point should be .015" to .020" (this will give the proper backlash between the bevel and pinion gears. If end play is not within these tolerances it will be necessary to remove the transmission from the differential, remove the pinion gear (Y) from the transmission, and reshim. If the end play is less than .015" you will need to add shims. If it is more than .020", you will need to remove shims. Coat bolt with Locktite 242 (or equivalent) and re-install gear washer and bolt and torque to 24ft-lbs. Re-assemble and check for end-play. Reinstall suction line on BOTTOM of hydro and rear axle.

3. Re-install return line between filter, base and side hydro.

4. Re-install pressure line to TOP of hydro.

5. Re-install control shaft. Torque locknut to 75 in-lbs.

6. Install drive shaft on input shaft. (Apply anti-seize to shaft). Tighten both set-screws.

7. Install fuel tank (on 2-speed Models, route shift shaft through left hand tank support). Secure tank with hardware removed earlier (Fig. 3-3).

8. Route fuel line and sending unit wires under fuel tank and install. Tie-strap wires and fuel line as needed.

9. Install range light panel and tighten hardware (Install new tie straps to secure wiring harness away from rotating parts).

10. Install fender. Route seat switch wire through fender and seat support. (Make sure grommets are in place).

11. Hook up seat switch wires. Install seat.

CAUTION

DO NOT OPERATE THIS VEHICLE IF THE SEAT SWITCH BECOMES INOPERATIVE. THE SEAT SWITCH IS DESIGNED TO SHUT DOWN THE TRACTOR ENGINE WITHIN THREE SECONDS FROM THE MOMENT THE SEAT IS LEFT

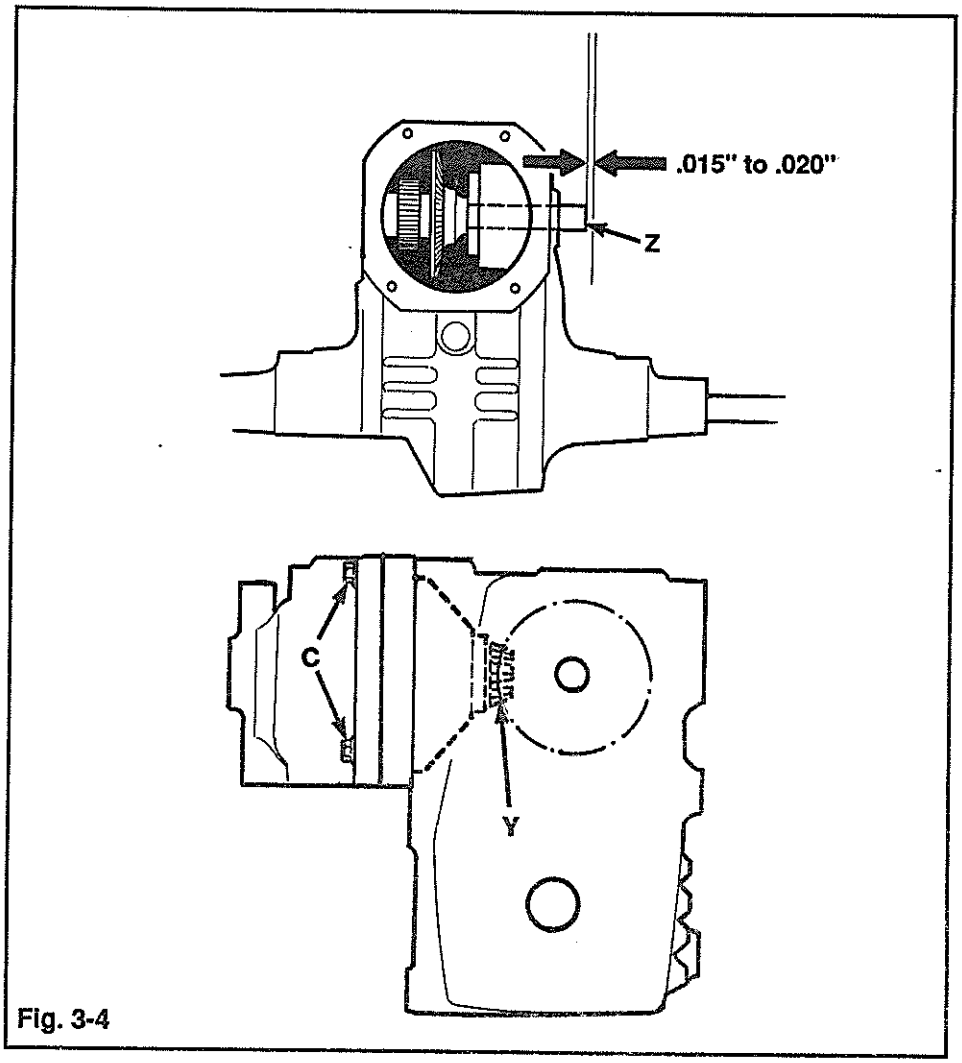


Fig. 3-4

HYDROSTATIC REMOVAL & RE-INSTALLATION (Cont.)

UNOCCUPIED. IF IT FAILS TO DO THIS, SERVICE THIS UNIT IMMEDIATELY! DO NOT OPERATE UNTIL THIS SERVICE IS COMPLETED. FAILURE TO DO SO COULD RESULT SERIOUS PERSONAL INJURY OR PROPERTY DAMAGE.

12. Install tunnel cover.

13. Fill transaxle with proper lubricant, Bolens P/N 1738157 or equivalent transmission / hydraulic oil. Remove any center or rear mount attachments and drain oil from the transaxle.

14. Remove spark plug from engine and crank for approximately 15 seconds to fill hydro with fluid. Re-install spark plug.

TRANSAXLE REMOVAL

1. Remove any center or rear mount attachments and drain oil from the transaxle.

2. Remove four (4) bolts (A, Fig. 3-5) securing tunnel cover (B).

3. Loosen seat (C) at screws and knobs (D). Remove from seat support. Disconnect seat switch wires (E) and remove seat.

4. **(TWO SPEED MODELS)** Remove roll pin (F) from shift lever (G). Remove shift lever.

5. Remove the 2-5/16 Flange Nuts (G) securing rear of fender and the 2-5/16 Flange Bolts (H) securing front of fender. Pull seat switch wires through seat support and fender. Remove fuel cap and lift fender and seat support off.

6. Cut the tie straps holding wire harness to hydraulic tubes (note position of tie straps for assembly).

7. Loosen the six bolts (I, [3 on each side]) that hold the range light panel to the frame. Disconnect the wires from the fuel sending unit and slide the panel forward out of the way.

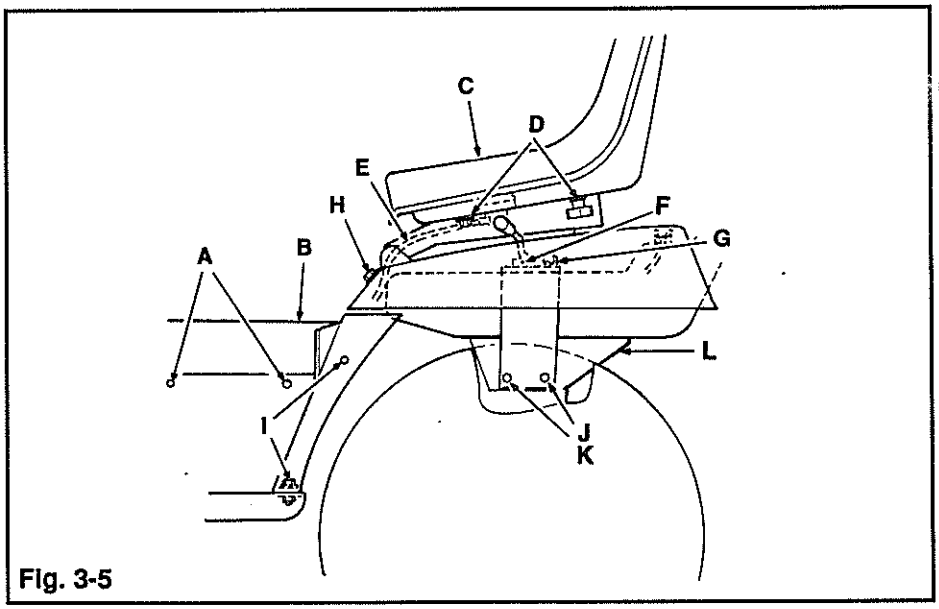


Fig. 3-5

8. Shut the fuel valve off and disconnect the fuel line. Some models are equipped with a clip that holds the line to the frame. Remove the clip–**Older Models** the fuel line is strapped to the frame. Cut the tie-straps (note position of tie-straps for re-assembly).

9. On the Left side of the tank, remove the two (2) lower 3/8 x 1 bolts and flange nuts (J, Fig. 3-5). On the right side, remove the lower two (2) 3/8 flange bolts (K) which are threaded into the rear axle housing (L). Remove fuel tank.

10. Loosen the 2 set screws securing engine driveshaft to transmission input shaft. Slide driveshaft all the way forward and let it rest on the rocker shaft.

TRANSAXLE REMOVAL

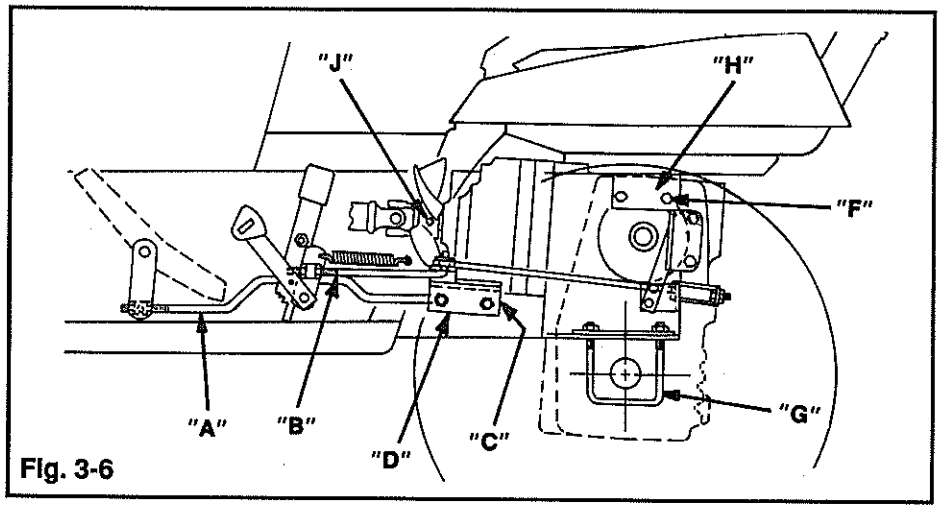


Fig. 3-6

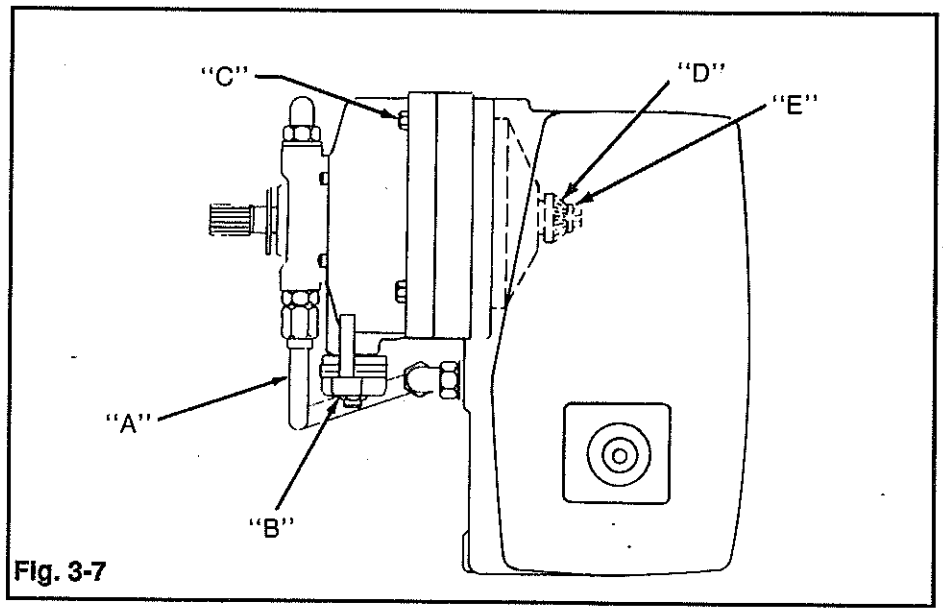


Fig. 3-7

11. Disconnect return line from side of Hydo. Disconnect pressure line from top of Hydro.

12. Remove cotter pin from pivot and disassemble brake rod (A, Fig. 3-7) from front cross shaft.

13. Remove cotter pin and washer from pivot and disassemble control rod (B) from the foot pedal shaft.

14. Scribe a line (C, Fig. 3-7) on the inside L.H. frame along the rear of the quadrant support plate (D). **NOTE:** This support must be removed and the scribed line will help in re-assembly later. Remove the quadrant support plate.

15. Place blocks under tractor at mid-frame.

16. Remove the screws securing the transaxle support (H). Remove axle U-Bolts (G). This will loosen the transaxle.

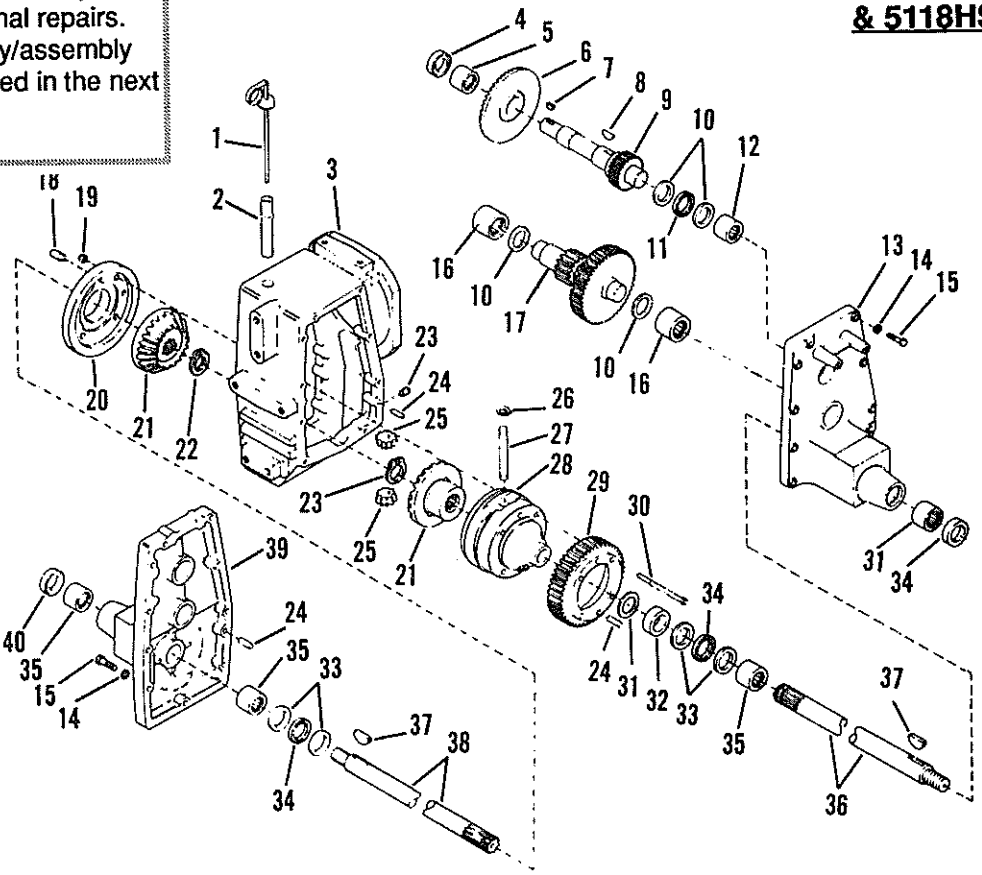
17. Slowly roll the complete transaxle and hydro back and out of the frame. ***NOTE: Refer to pages 3-8 & 3-9 for exploded view of complete transaxle assembly.***

DRIVE TRAIN (Continued)

TRANSAXLE DISASSEMBLY
HYDROSTATIC MODELS

Dismantle the complete transaxle assembly and inspect all the parts when performing internal repairs. Follow the disassembly/assembly procedures as described in the next few pages.

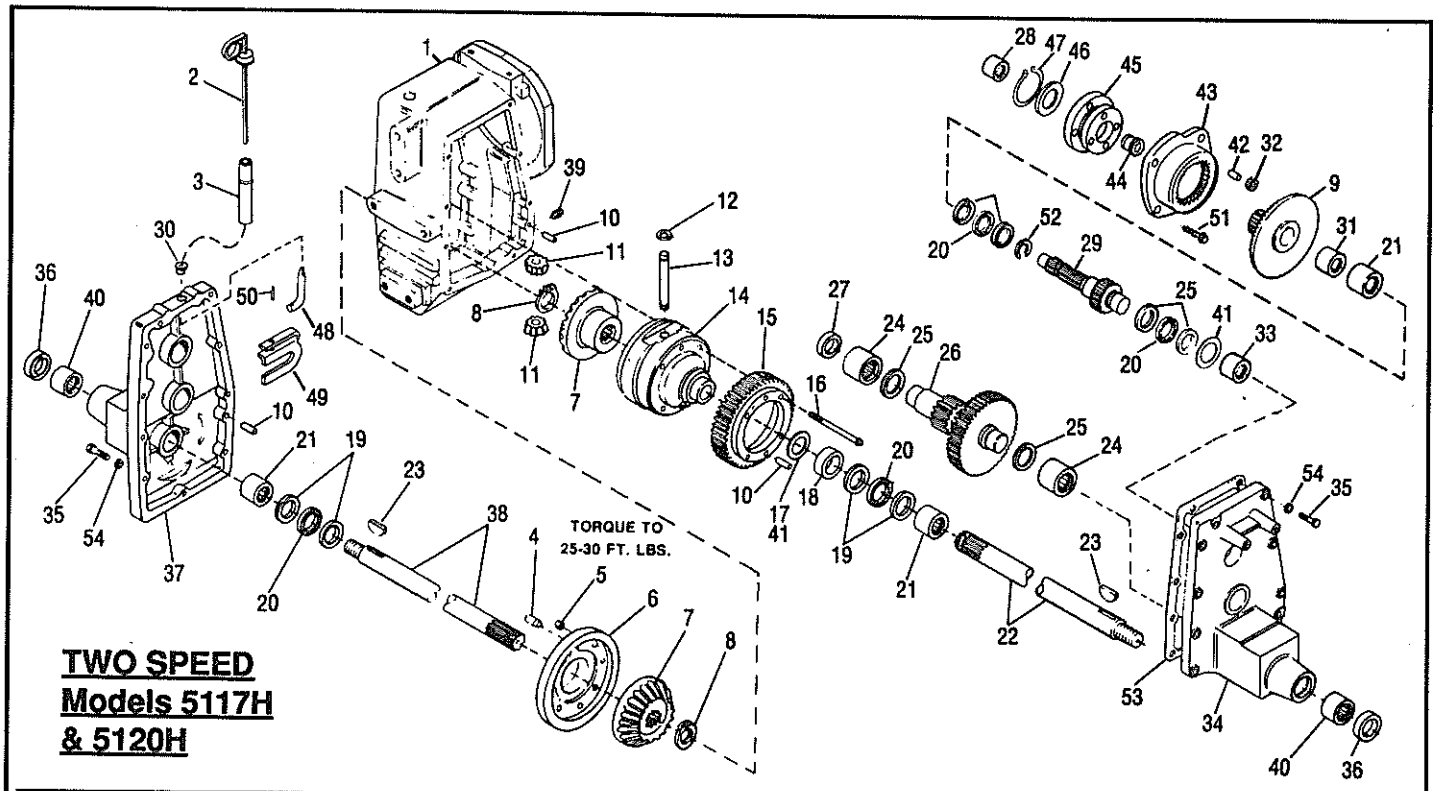
SINGLE SPEED
Models 5118H & 5118HS



Ref #	Description	Qty.
1	Dipstick	1
2	Tube	1
3	Transaxle housing	1
4	Oil Seal	1
5	Needle Bearing	1
6	Gear 56T	1
7	Woodruff Key	1
8	Woodruff Key	1
9	Pinion Shaft Ass'y 24T	1
10	Thrust Race	4
11	Thrust Bearing	1
12	Needle Bearing	1
13	R.H. Transaxle Cover	1
14	Lock Washer 3/8	17
15	Hex Hd. Screw 3/8-16 x 1-1/2	17
16	Needle Bearing	2
17	Gear Ass'y 50T - 16T	1
18	Dowel Pin	1
19	Hex Lock Nut 3/8	4
20	Differential Cover	1

Ref #	Description	Qty.
21	Gear 22T	2
22	Retaining Ring	2
23	Pipe Plug	1
24	Dowel Pin	6
25	Pinion 10T	2
26	Retaining Ring	2
27	Pinion Shaft	1
28	Differential Carrier	1
29	Axle Gear 47T	1
30	Flange Screw 5/16-18 x 4	4
31	Shim	1
32	Tubular Spacer	1
33	Thrust Race	4
34	Thrust Bearing	2
35	Needle Bearing	1
36	R.H. Axle	1
37	Woodruff Key	1
38	L.H. Axle	1
39	L.H. Transaxle Cover	1
40	Oil Seal	1

TRANSAXLE DISASSEMBLY
HYDROSTATIC MODELS



TWO SPEED
Models 5117H
& 5120H

Ref #	Description	Qty.
1	Transaxle Housing	1
2	Dipstick	1
3	Tube	1
4	Dowel Pin, 5/16	2
5	Hex Lock Nut, 5/16-18 Grade 8	4
6	Differential Cover	1
7	Bevel Gear, 22T	2
8	Retaining Ring	2
9	Bevel Gear, 56T, 24T & 23T	1
10	Dowel Pin, 3/8	6
11	Pinion	2
12	Retaining Ring	2
13	Pinion Shaft	1
14	Differential Carrier	1
15	Axle Gear 47T	1
16	Flange Screw, 5/16-18 x 4.0	4
17	Shim	A/R
18	Tubular Spacer	1
19	Thrust Race	4
20	Thrust Bearing	4
21	Needle Bearing	3
22	R.H. Axle	1
23	Woodruff Key	2
24	Needle Bearing	2
25	Thrust Race	6
26	Cluster Gear Ass'y	1
27	Oil Seal	1

Ref #	Description	Qty.
28	Needle Bearing	1
29	Pinion Shaft	1
30	Oil Seal	1
31	Bronze Bearing	1
32	Planet Gear	4
33	Needle Bearing	1
34	R.H. Transaxle Cover	1
35	Hex Hd. Capscrew, 3/8-16 x 1-1/2	17
36	Oil Seal	2
37	L.H. Transaxle Cover	1
38	L.H. Axle	1
39	Pipe Plug	1
40	Needle Bearing	2
41	Shim (.005)	A/R
42	Pin	4
43	Internal Ring Gear	1
44	Sliding Gear	1
45	Planet Carrier	1
46	Thrust Washer	1
47	Retaining Ring	1
48	Shifter Shaft	1
49	Shifter Plate	1
50	Drive Pin	4
51	Counter Box Screw, 5/16-18 x 1	4
52	Positioning Ring	4
53	R.H. Gasket Cover	1
54	Lock Washer, 3/8	4

TRANSAXLE DISASSEMBLY
HYDROSTATIC MODELS

NOTE: SEE TRANSAXLE REMOVAL, PAGE 3-6 AND HYDROSTATIC REMOVAL, PAGE 3-4 BEFORE SERVICING TRANSAXLE. TRANSAXLE ASSEMBLY MUST BE REMOVED FROM TRACTOR AND HYDRO MUST BE REMOVED FROM TRANSAXLE BEFORE TRANSAXLE CAN BE SERVICED.

1. Remove right-hand wheel Hub. Remove brake disc from right-hand end of pinion shaft.

(Fig 3-8)

2. Set transaxle on left-hand wheel assembly and wedge a brace (A) between the left-hand wheel assembly and left-hand transaxle cover (B). (This brace will prevent transaxle from sliding down axle during disassembly and will aid in alignment during re-assembly).

CAUTION

DO NOT DISASSEMBLE WITH TRANSAXLE PROPPED ON RIGHT-HAND WHEEL ASSEMBLY. TRANSAXLE CANNOT BE RE-ASSEMBLED FROM THIS SIDE.

3. Remove eight (8) bolts (C) holding right-hand transaxle cover (D). Remove right-hand transaxle cover. Clean any gasket residue or sealant off cover flanges.

NOTE: KEEP TRACK OF THE POSITIONS OF ALL SHIMS, WASHERS AND GASKETS REMOVED DURING DISASSEMBLY. THESE ITEMS WILL HAVE TO BE RE-INSTALLED DURING RE-ASSEMBLY.

REPLACE DAMAGED OR BADLY WORN SHIMS AND WASHERS, AND ALL GASKETS DURING RE-ASSEMBLY. USE ONLY ORIGINAL BOLENS PREPLACEMENT PARTS.

(Fig. 3-9)

4. Remove nine (9) bolts holding left-hand transaxle cover and lift off center transaxle cover. Clean any gasket residue or sealant off cover flanges.

5. Simultaneously lift pinion/bevel gear assembly (E) and reduction gear assembly (F) out of gear case. NOTE: pinion gear assembly may require a slight tug or a rubber mallet to dislodge.

6. Scribe a positioning mark (G) on gear case and planetary assembly (I) (this will aid in re-assembly later). Remove four (4) bolts (H) securing planetary assembly. Remove planetary assembly. **NOTE:** for servicing of planetary assembly see page 3-14).

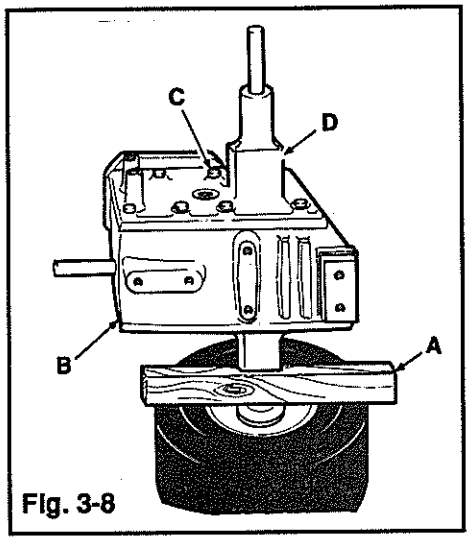


Fig. 3-8

7. If differential disassembly is required, it will be necessary to remove the left-hand wheel and hub at this time. Axle/differential assembly will then lift out. **NOTE:** For differential servicing, see page 3-12.

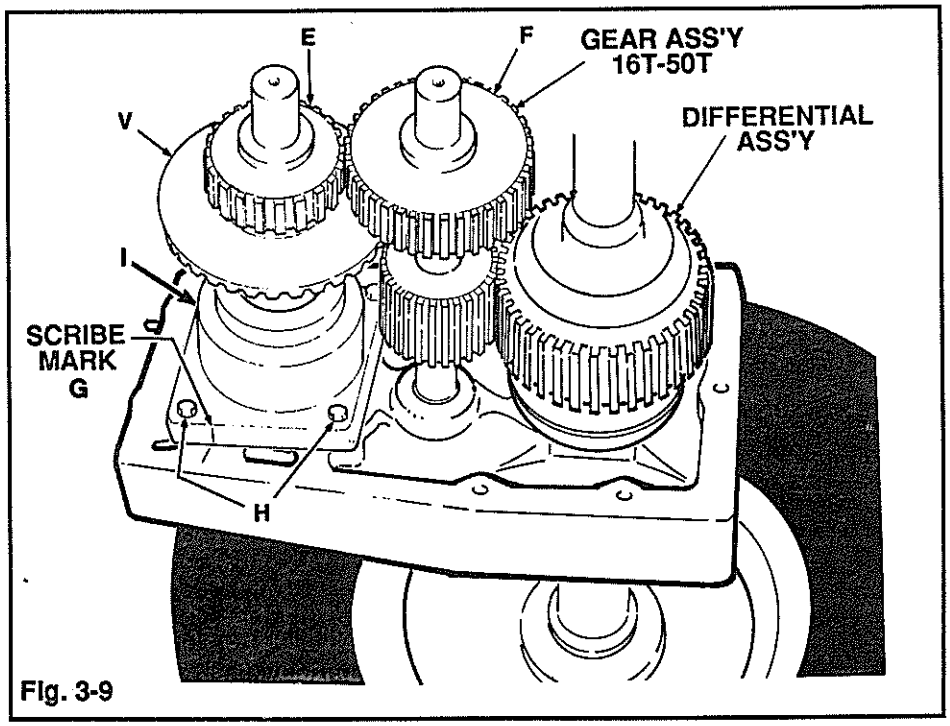


Fig. 3-9

TRANSAXLE DISASSEMBLY
HYDROSTATIC MODELS

8. For transaxle re-assembly, proceed to page 3-13.

On single speed models, the 56T bevel gear (V, Fig. 3-8) can be removed from the pinion shaft if replacement is necessary. A woodruff key is used to prevent the bevel gear from turning on the pinion shaft.

DIFFERENTIAL ASSEMBLY/RE-ASSEMBLY
HYDROSTATIC MODELS

DISASSEMBLY

(Figs. 3-10 & 3-11)
Remove four (4) 5/16 ferry head bolts (J) from differential case. To open case from this point, it may be necessary to set the differential/axle assembly onto the end of the right-hand axle (refer to Fig 3-8), and then tap gently down on the bull gear with a soft-faced mallet. The remaining internal parts inside the differential can be disassembled, if necessary, by removing snap rings. Pay close attention during disassembly of these items so they can be re-assembled in the proper manner.

Check internal parts for excessive wear or damage. Replace if necessary. USE ONLY GENUINE BOLENS REPLACEMENT PARTS.

RE-ASSEMBLY

Re-assemble any internal differential parts that were taken apart. The two pinion gears slide on the pinion shaft and are held in position by the side gears when the carrier is assembled.

NOTE: BOLT HEADS ON DIFFERENTIAL ASSEMBLY SHOULD BE ON THE RIGHT-HAND SIDE.

When the internal differential parts have been re-assembled, put the differential case back together and install the four (4) ferry head bolts (J). Torque to 25 to 30 ft. lbs. (33 to 40 N-m).

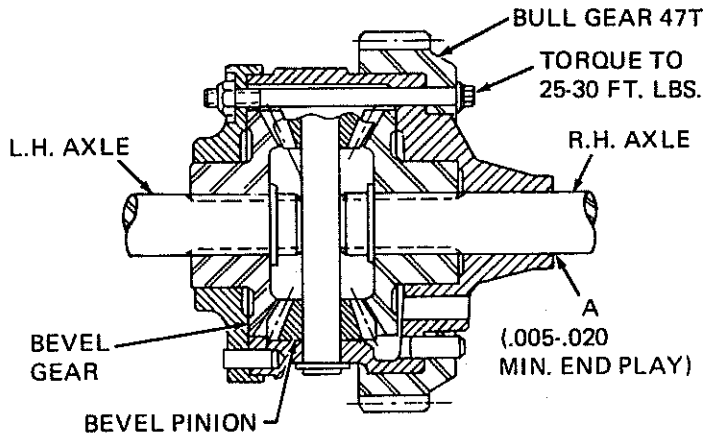


Fig. 3-10

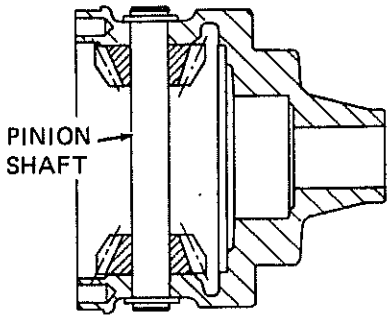


Fig. 3-11

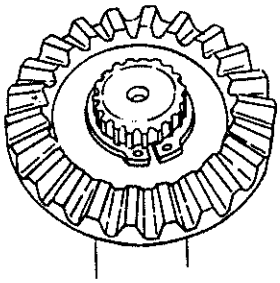


Fig. 3-12

TRANSAXLE RE-ASSEMBLY
HYDROSTATIC MODELS

Before re-assembly, check all internal parts for excessive wear or damage and replace if necessary. USE ONLY GENUINE BOLENS REPLACEMENT PARTS.

(Figs. 3-13 & 3-14)
Check interior needle bearings inside housings. If needles show signs of pitting or any other damage, replace them. Use a needle bearing driver and seat bearings to a depth of 1/32" to 1/16" (0.78 -- 1.57 mm) below the machined surface for the upper two bearings. The interior axle bearing must be seated to a depth of 1/4" (6.4 mm) below the machined surface.

NOTE
ALWAYS INSTALL THE NEEDLE BEARINGS WITH THE STAMPED END (THE END WITH IDENTIFICATION MARKINGS) AGAINST THE BEARING DRIVING TOOL.

(Fig. 3-14)
Check exterior axle bearings in ends of axle housings. Service these bearings the same as interior bearings. Exterior bearings should be seated 1/32" to 1/16" (0.78 - 1.57 mm) below counter bore for the axle seal.

Axle seals should be replaced whenever unit is disassembled. Use a seal driver to drive seals until they bottom in axle housing counter bore

NOTE: REFER TO PAGE 3-19 FOR BEARING AND SEAL INSTALLATION PROCEDURES.

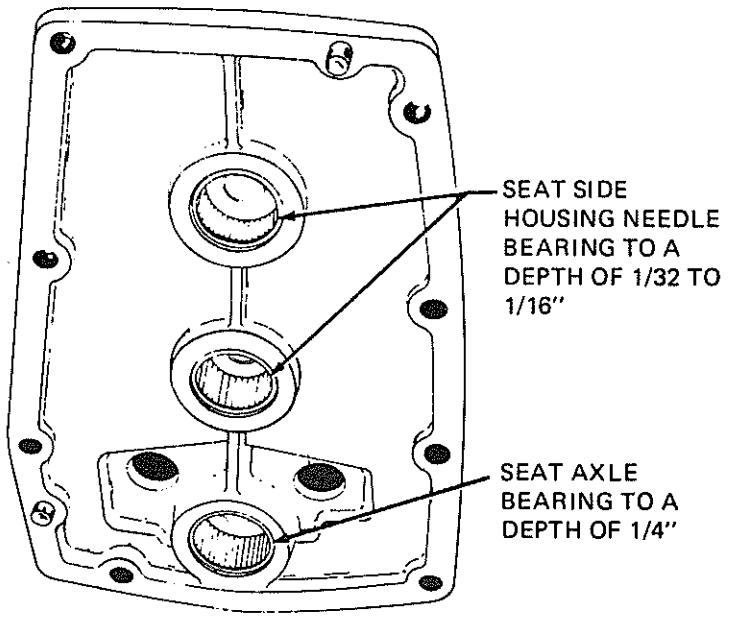


Fig. 3-13

Install differential carrier / axle assembly into the left side housing. Be careful not to damage axle seal when installing it in end of housing. Make sure all shims and washers are in place as they were when removed. See Figs. 3-14 & 3-15 for reference.

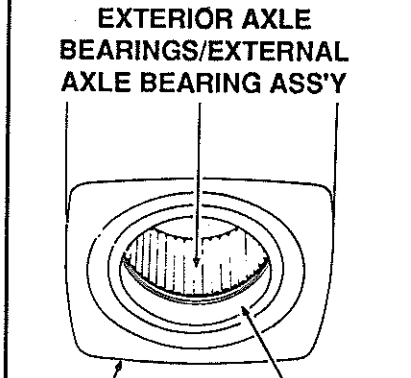


Fig. 3-14

PLANETARY
TWO-SPEED MODELS ONLY

DISASSEMBLY

1. Scribe a positioning mark (G, Fig. 3-15) on gear case and Planetary assembly (I) (this will aid in re-assembly later).

2. Loosen the four bolts (A) securing the planetary assembly to the transaxle case. Remove the planetary assembly.

3. Remove snap ring (C, Fig. 3-16). Entire planetary assembly should come apart. Note position of all bushings and washers for re-assembly.

4. If individual planet gears (D) must be disassembled, drive Pins (E) toward snap ring groove.

5. Replace all worn or damaged parts. If any planet gears (D) need replacement, replace all of them, including pins.

ASSEMBLY

1. Re-assemble the planetary in reverse order of disassembly. When re-assembling individual planet gears (D), drive in pins (E) until they seat.

2. Re-install planetary assembly in transaxle case when re-installing pinion shaft assembly (See page 3-16). Remember to match up scribe mark (G, Fig. 3-15) made in step 1, "DISASSEMBLY".

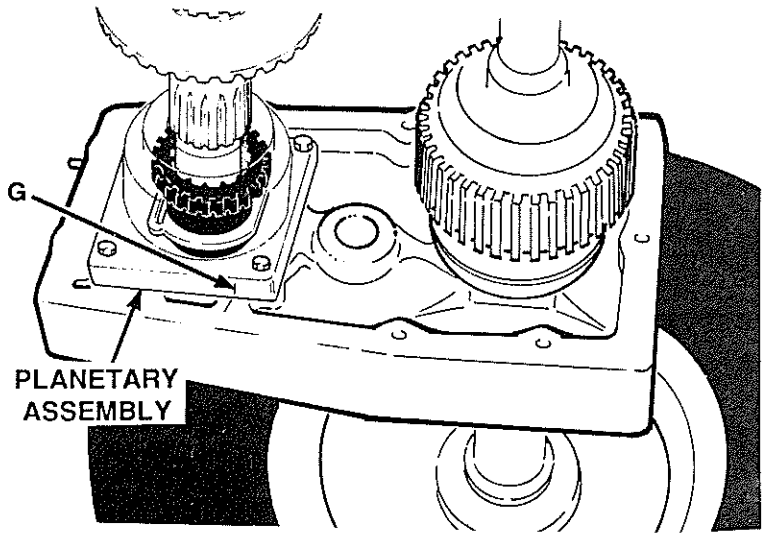
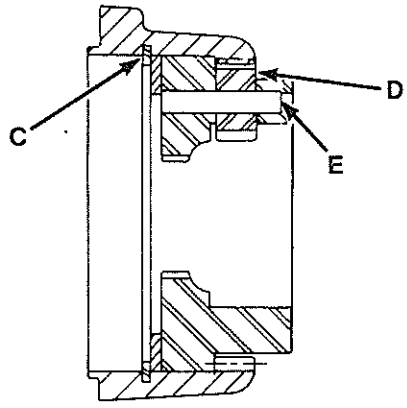


Fig. 3-15



CROSS-SECTION OF
PLANETARY
ASSEMBLY

Fig. 3-16

TRANSAXLE RE-ASSEMBLY (Continued)
HYDROSTATIC MODELS

Models 5117H & 5120H

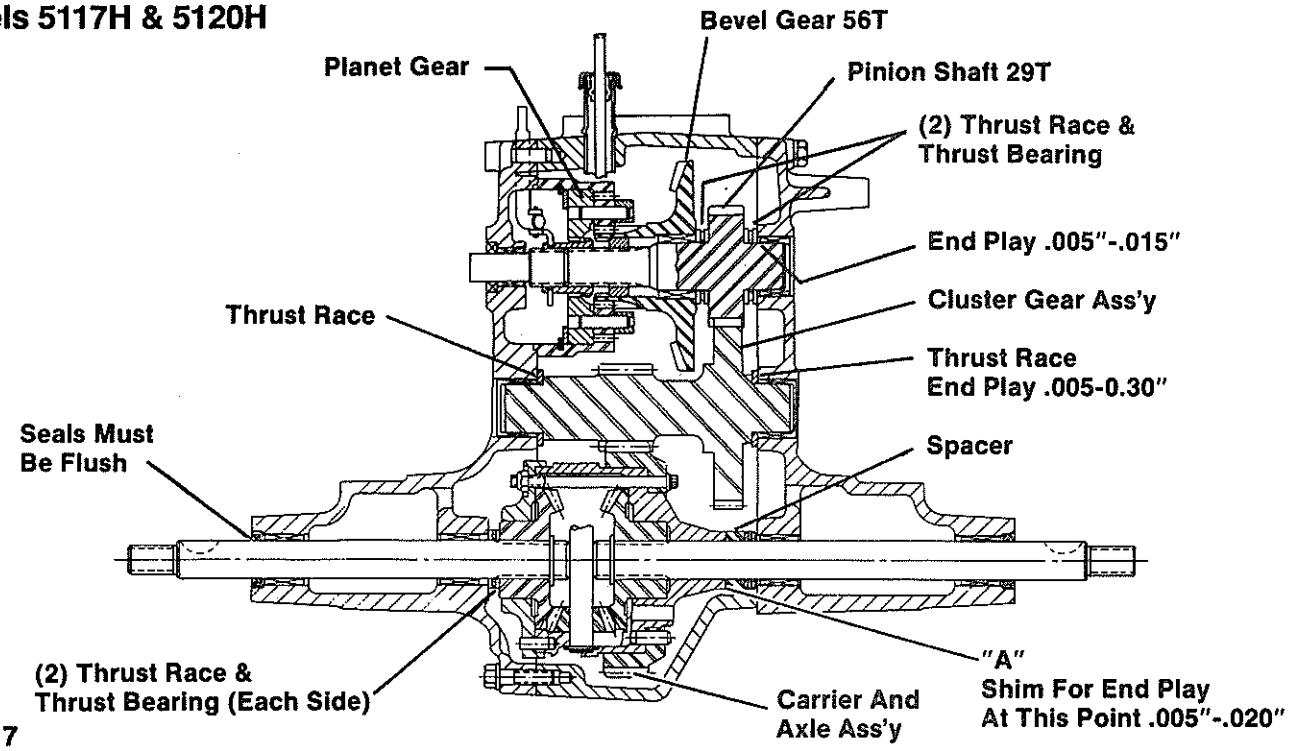


Fig. 3-17

Model 5118H

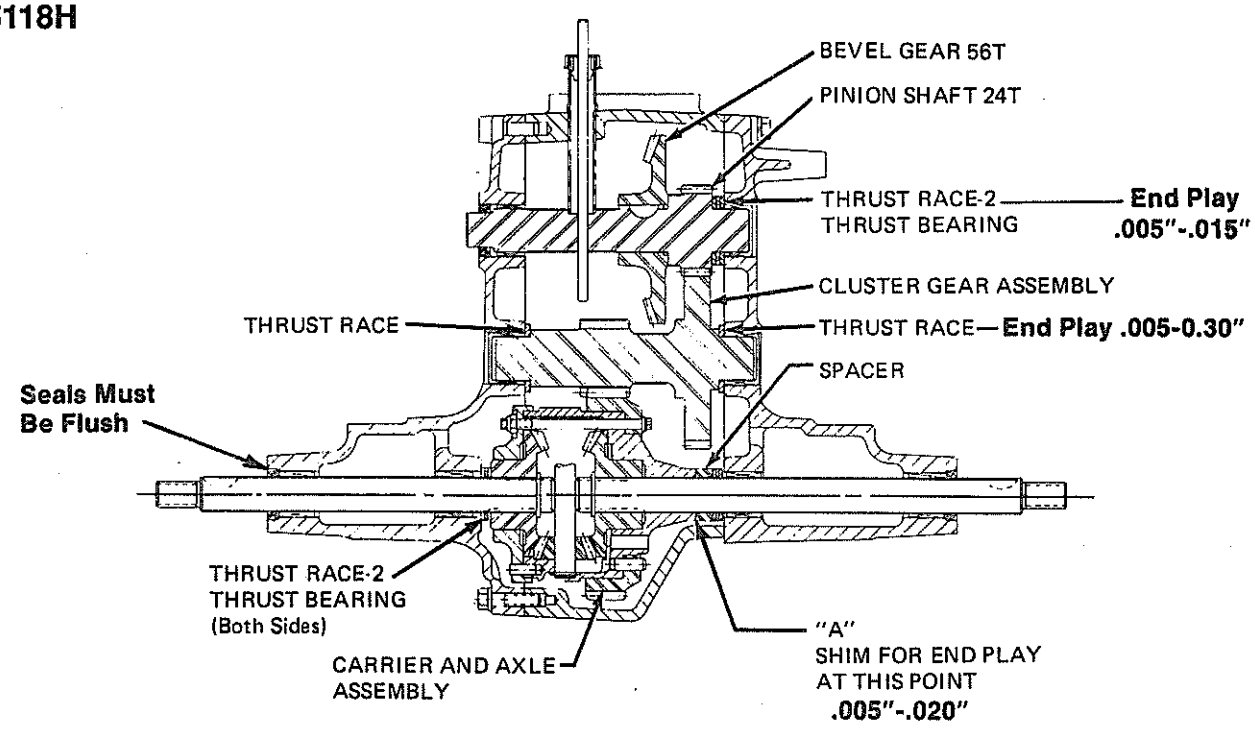


Fig. 3-18

TRANSAXLE RE-ASSEMBLY (Continued)
HYDROSTATIC MODELS

TWO-SPEED PINION / SLIDING GEAR ASSEMBLY

(Figs. 3-19)
1. Slide thrust race, thrust bearing and another thrust race (A) onto pinion shaft (B).

2. Place pinion shaft through roller and needle bearings (C) in bevel gear (D).

3. Put a layer of grease over pinion shaft at shaded area (M). Carefully place positioning ring (E) in groove of pinion shaft. Be careful not to over-stretch the ring.

4. Slide sliding gear (F) over the positioning ring into the first detent. This will center positioning ring in the groove of the pinion shaft. It may be necessary to tap the sliding gear with a soft-faced hammer. Remove sliding gear from pinion shaft. The grease applied in step 2 should hold positioning ring in place. TAKE CARE THAT THE POSITIONING RING IS NOT DISTURBED FROM THIS CENTERED POSITION. Set this assembly aside.

(Fig.3-20)
5. If the shifter shaft (N) has been removed, re-install it and the shifter fork (O) at this time as shown. Install roll pin into shifting arm and fork.

(Fig. 3-21)
6. Place sliding gear (F) into shifting fork (O).

7. Install planetary carrier assembly over the sliding gear as shown. Install four screws (H), but do not tighten. Match up scribe mark made in step 1, Pg. 3-14 (G. Fig. 3-15). Position pinion shaft assembly down through planetary carrier and sliding

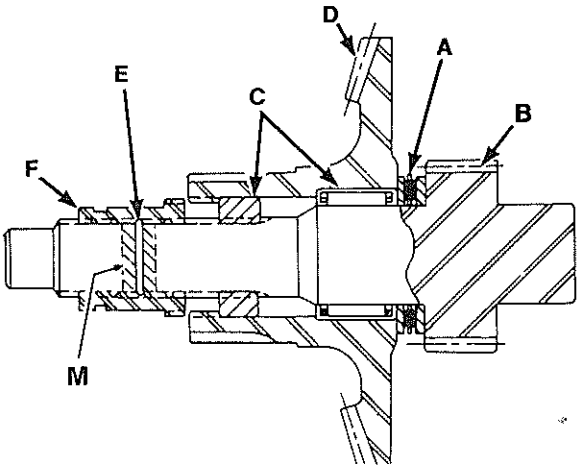


Fig. 3-19

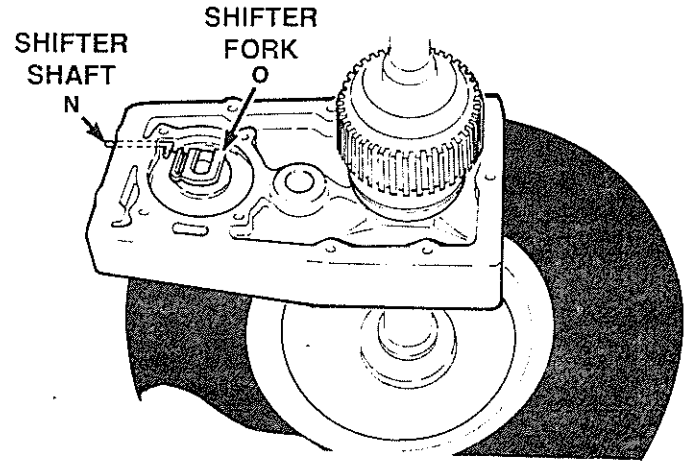


Fig. 3-20

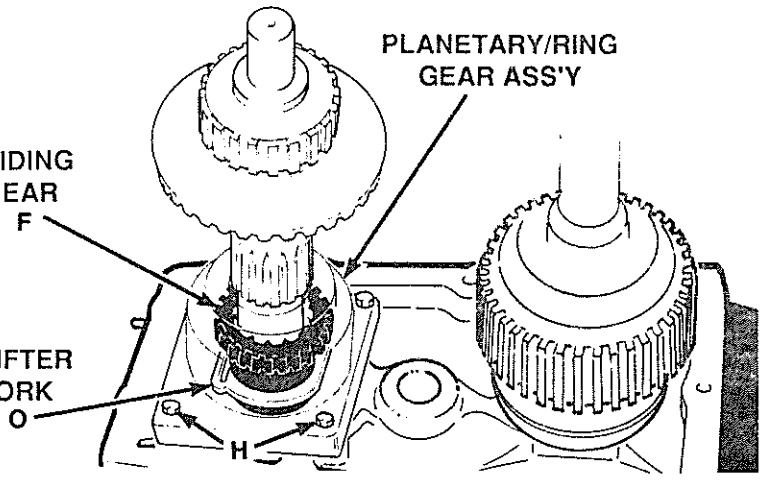


Fig. 3-21

TRANSAXLE RE-ASSEMBLY
HYDROSTATIC MODELS

gear, and gently tap pinion shaft down until positioning ring pops into the first groove in the sliding gear (be careful the position ring is not damaged while doing this). Check to see that the positioning ring is in the groove by lifting on the Pinion gear--if the ring is in the groove, the shaft will resist being pulled out of the groove. Torque four screws securing planetary to the Transaxle to 18 ft/lbs (24 N/m).

(Fig. 3-22)

8. Install the reduction gear assembly by first lifting the pinion assembly and meshing the reduction gear assembly in place between the pinion gears and the differential bull gear, as shown. Make sure all shims and washers are on the ends of all shafts as they were when removed. See Figs. 3-17 & 3-18 for reference. The right side of the pinion shaft must have a thrust bearing assembly. The cluster gear must have a thrust washer. The axle shaft must have a spacer and Torrington bearing assembly (Fig 3-18).

9. If the left hand-cover flange had a gasket, replace at this time, if not, apply a 1/32" (0.8 mm) bead of sealant around the flange. Keep bead along the inside edge of cover flange (do not allow sealant into bolt holes). Be careful not to damage

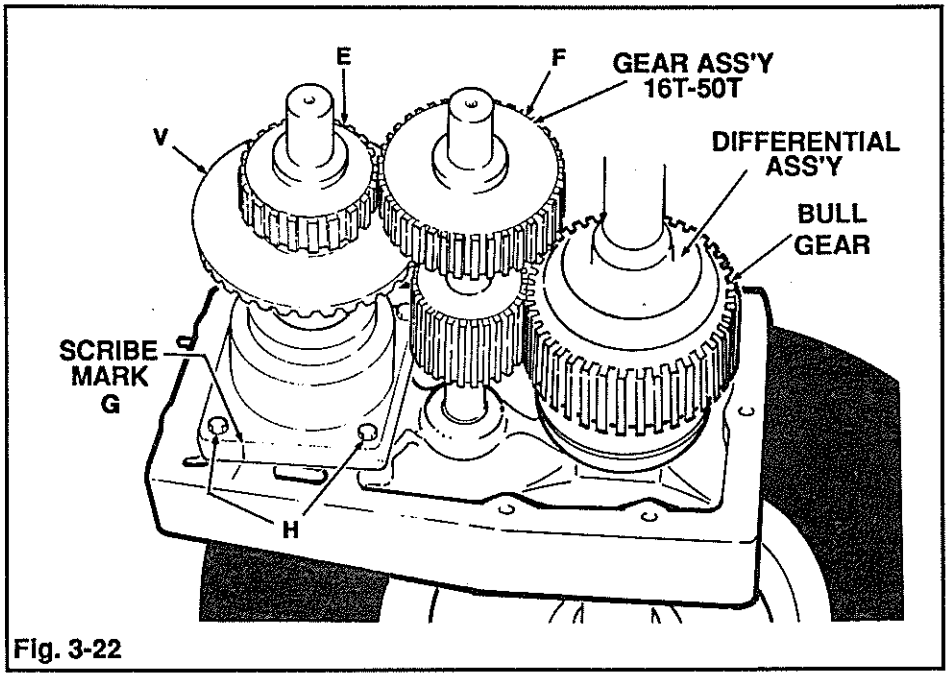


Fig. 3-22

axle seat. **DO NOT FORCE BOLTS INTO CASTINGS! THREADS, OR CASTINGS CAN BE DAMAGED VERY EASILY BY THIS PRACTICE.**

10. Bolt left side housing to the center housing. Torque housing cap screws to 30 ft.-lbs. (40 N/m).

11. Install right-hand cover and check for end-play. Refer to Figs. 3-17 and 3-18 for end-play specifications.

12. If the right-hand cover had a gasket, replace, if not run a bead of sealant in the same manner as in step 8. Position cover and torque capscrews to 30 ft-/lbs. (40 N/m). **DO NOT FORCE BOLTS INTO CASTINGS! THREADS OR CASTINGS CAN BE DAMAGED VERY EASILY BY THIS PRACTICE.**

TRANSAXLE RE-ASSEMBLY
HYDROSTATIC MODELS

OIL SEAL INSTALLATION

1. Be sure housing bore diameter, bore depth and shaft diameter are correct and within the recommended tolerances. Inspect all surfaces for scratches or nicks.

4. Be sure sealing lip has not been damaged.

5. Lubricate sealing lips with any light machine oil before installing.

6. Apply a light coat of any suitable sealing compound to outside edges of seals to provide a margin of safety against seepage through the press-fit in housing bore. Extreme care must be taken to avoid depositing any compound on the sealing member.

7. Install seal with lip facing lubricant.

(Fig. 3-23)
8. Use a seal protector when installing seals.

9. Press seal into housing with a smooth, uniform pressure applied by a press-fitting tool (C). If shaft is already in place, use a sleeve-type press-fitting tool.

10. Whenever possible, use an arbor press to insert seal into housing. Be sure seal is not cocked when applying pressure. It is best to seat seal against a shoulder in the bore to help prevent cocking of the seal.

11. When the shaft is assembled from reverse side of sealing lip, no special precautions are required other than removing all burrs and sharp corners from shaft. When the shaft enters against the sealing lip, a tapered sleeve made to the dimensions shown at (A) must be used. Use a sleeve as shown (B), when seal must pass splines, keyways or holes. The edges of the splines, keyway or holes should be rounded and lubricated with a heavy grease if the use of an assembly sleeve is not possible.

12 If the machine is to be painted where seals are exposed, mask the shaft and sealing lip to prevent paint from being deposited in these areas. If the paint is to be baked on, be sure the baking temperature does not exceed the operating temperature of the seal to avoid damaging the sealing member.

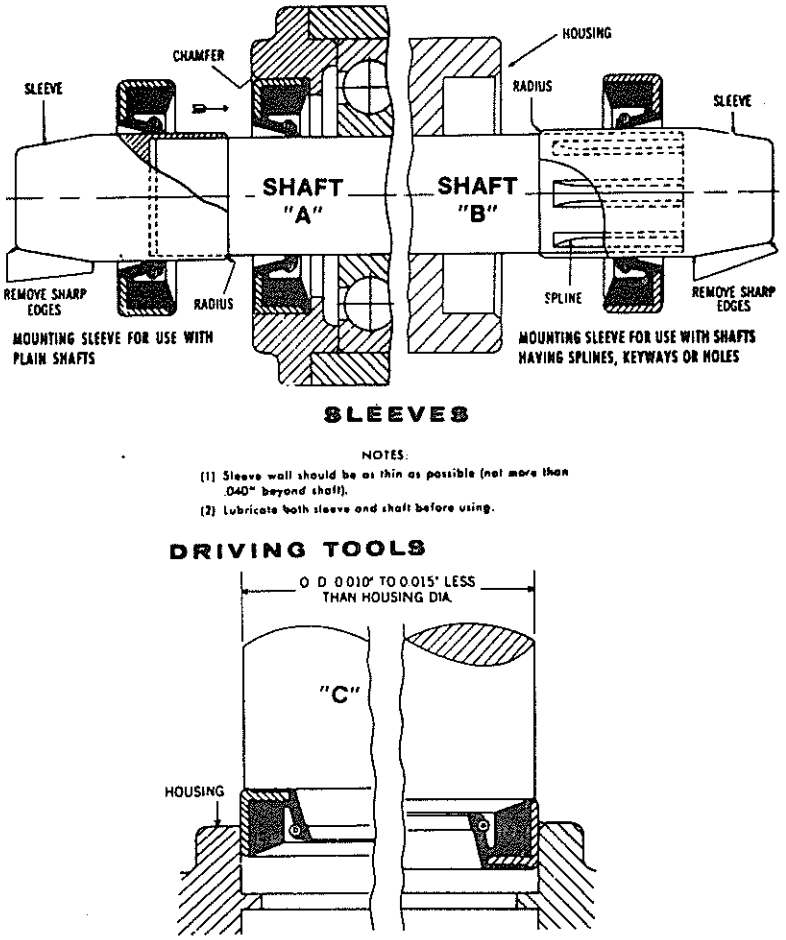


Fig. 3-23

TRANSAXLE ASSEMBLY PROCEDURE (Continued)
HYDROSTATIC MODELS

BEARING INSTALLATION

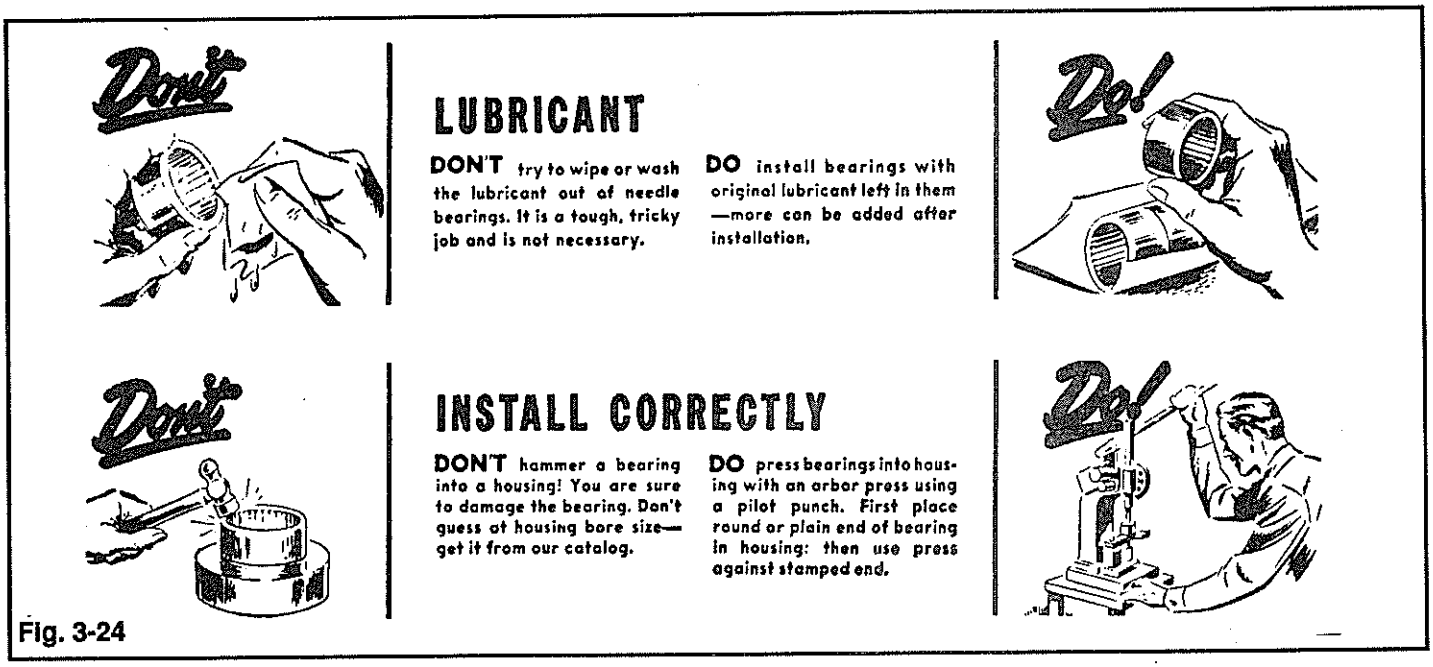


Fig. 3-24

(Figs 3-24 & 3-25)

1. Use an arbor press, or a similar method, whenever possible (as illustrated).

2. The punch should have a pilot to keep the bearing in line, as shown.

3. Place the stamped end of the bearing against the shoulder of the punch. The un-stamped end of the bearing will lead best into the housing bore.

4. Do not wipe the grease off the bearings. Do not allow dirt to contaminate the grease.

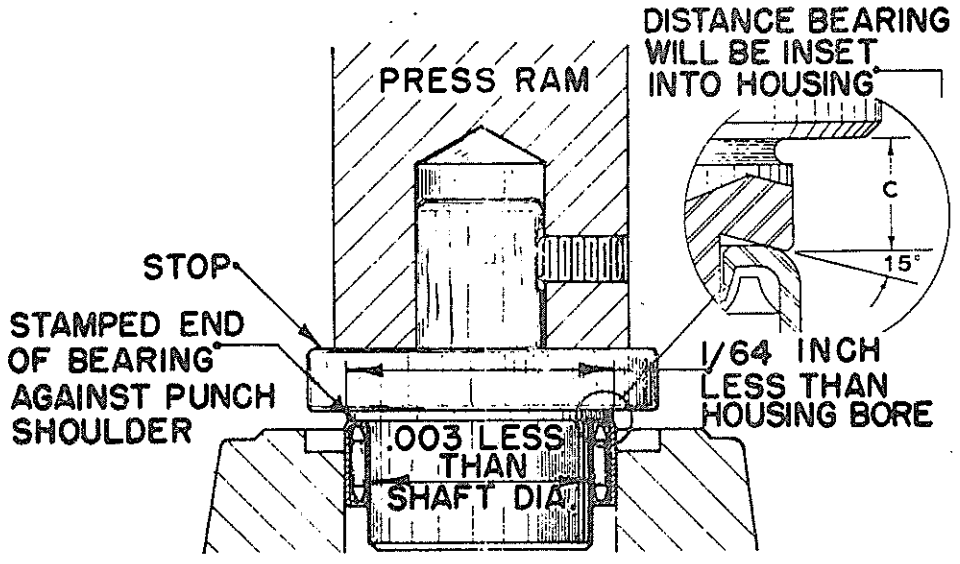


Fig. 3-25

DRIVE TRAIN (Continued)

TRANSAXLE RE-INSTALLATION
HYDROSTATIC MODELS

NOTE: Hydro should be installed in transaxle before continuing (See pg. 3-5).

1. Position quadrant support plate (D) and linkage into place before assembly.

2. Tip the quadrant up and walk the transaxle into the frame.

NOTE: On later models it may be necessary to raise the frame even further off the blocks to clear the fuel tank support.

(Fig. 3-26)
3. Stabilize the transaxle by temporarily installing a mounting screw and nut into one of the top left hand transaxle support holes (F) in the frame.

4. Position the quadrant support plate in place using the scribed line (C, Figs. 3-7 & 3-26, [made in step 13, page 3-7) and tighten. Plate must be parallel with frame after assembly.

NOTE: Make sure all rods are in the right position for later assembly.

5. Position the two (2) axle U-bolts (G), in place with the flat support spacer and turn the nuts on a few turns.

6. Remove the blocks from beneath the frame.

7. Align the seat support bracket (H) over the frame and fasten the (4) mounting screws and two (2) nuts into the frame.

8 Tighten the four (4) U-bolt nuts.

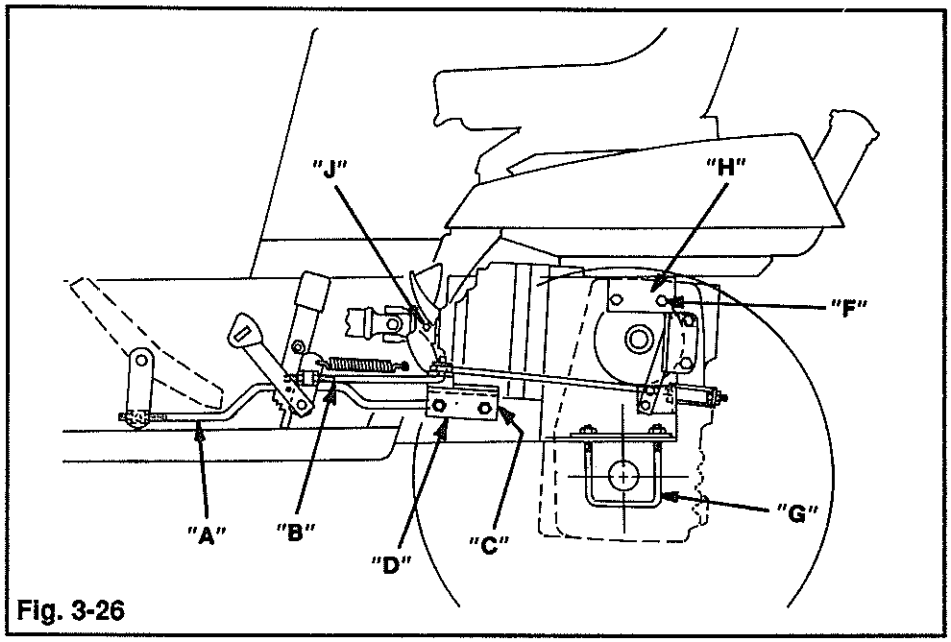


Fig. 3-26

9. Slide driveshaft onto input shaft and secure driveshaft hub with set screws.

NOTE: Provide 1/8" clearance between hydro and driveshaft hub. Make sure that the two-piece driveshaft is properly installed. The arrows on the two parts must align with one another.

10. Secure the brake rod (A) in the lower hole of the cross shaft arm with the cotter pin removed in step 11, page 3-6.

11. Secure hydrostatic control rod (B) in place with the washer and cotter pin removed in step 12 page 3-6.

12. Re-connect and tighten the two (2) hydraulic tubes to the hydro.

13. Fill the transaxle with approximately 8 qts. (7.5L) of Bolens P/N 1738157 or equivalent transmission / hydraulic fluid. Change oil filter if necessary.

14. Re-install the fuel tank and secure on the left side with two (2) 3/8 x 1 bolts and flange nuts in the lower holes (J, Fig. 3-27), and on the right side, with two (2) 3/8 flange bolts in the lower holes (K) which are threaded into the rear axle housing.

15. Re-connect the fuel line and clip or tie-strap the line to the frame as required.

16. Re-install the range light panel and secure with the six bolts (I) remove in step 7, page 3-6. Re-connect the leads to the fuel sending unit.

17. Re-install the fender and secure at the rear with 2-5/16 flange nuts and at the front with 2-5/16 flange bolts. Route seat switch wire through fender and seat support. (Make sure grommets are in place). Re-install fuel cap.

TRANSAXLE RE-INSTALLATION
HYDROSTATIC MODELS

18. Re-install seat and secure at screws and knobs (D). Re-connect seat switch wires.

19. Re-install tunnel cover (B) and secure with four (4) bolts (A).

20. Fill transaxle with proper lubricant, Bolens P/N 1738157 or equivalent transmission / hydraulic oil. Remove any center or rear mount attachments and drain oil from the transaxle.

21. Remove spark plug from engine and crank for approximately 15 seconds to fill hydro with fluid. Re-install spark plug.

22. Start unit and operate at a low engine RPM. If equipped, actuate hydraulic lift lever. This will fill the rest of the system with fluid. Shut off tractor engine.

23. Carefully block up rear of tractor. Place travel pedal into neutral position. Start the engine and release the brakes. If the wheels move in a forward direction, move quadrant support plate (D) toward the front of the tractor. If the wheels move in the reverse direction, move the support plate toward the rear.

24. Stop unit and check fluid level. Add fluid if necessary.

WARNING

DO NOT OPERATE THIS VEHICLE IF THE SEAT SWITCH BECOMES INOPERATIVE. THE SEAT SWITCH IS DESIGNED TO SHUT DOWN THE TRACTOR ENGINE WITHIN THREE SECONDS FROM THE MOMENT THE SEAT IS LEFT UNOCCUPIED. IF IT FAILS TO DO THIS, SERVICE THIS UNIT IMMEDIATELY! DO NOT OPERATE UNTIL THIS SERVICE IS COMPLETED. FAILURE TO DO SO COULD RESULT SERIOUS PERSONAL INJURY OR PROPERTY DAMAGE.

TROUBLE SHOOTING GUIDE
GASOLINE ENGINES
Models 5118H, 5118HS & 5120H

PROBLEM	PROBABLE CAUSE	REMEDY
Hard starting.	1. Choke linkage not working properly.	1. Check linkage and repair.
	2. Dirt in fuel system.	2. Clean fuel lines, carburetor, and install new fuel filter.
	3. Engine flooded.	3. Check linkage, carburetor float setting, etc.
	4. Carburetor out of adjustment.	4. Adjust carburetor.
	5. Water in fuel system.	5. Clean system and refill with fresh fuel.
	6. Dirty air filter.	6. Install new air filter.
No fuel reaches carburetor	1. Empty fuel tank.	1. Refill tank
	2. Fuel filter plugged.	2. Replace fuel filter
	3. Shut off valve closed.	3. Open Valve.
	4. Gas tank vent plugged.	4. Clean out vent.
	5. Fuel pump not working.5.	Repair or replace fuel pump
Carburetor leaks.	1. Loose fuel line fitting.	1. Tighten fuel line.
	2. Carburetor float setting set too high.	2. Adjust float.
Engine starts but runs rough with low power output.	1. High or low speed mixture adjustment off.	1. Readjust carburetor.
	2. Incorrect float setting.	2. Adjust float.
	3. Dirty air filter.	3. Install new air filter.
	4. Carburetor loose on engine block.	4. Tighten carburetor mounting screws.

NOTE:
Refer to engine manual for detailed servicing information.

FUEL SYSTEM (Continued)

SERVICING
GASOLINE ENGINES

TYPICAL FUEL FLOW DIAGRAM

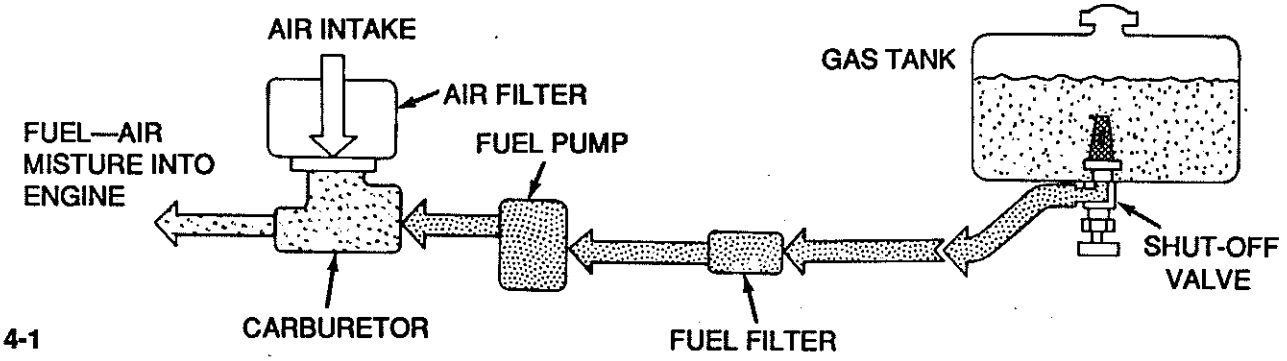


Fig. 4-1

FUEL TANK

Fill with a good, clean, fresh grade of unleaded gasoline

CAUTION

DO NOT MIX OIL WITH GASOLINE. REFUEL OUTDOORS. DO NOT REFUEL WHILE ENGINE IS RUNNING. ALLOW ENGINE TO COOL BEFORE REFUELING.

Check to see that vent hole in fuel tank cap is not plugged.

FUEL VALVE

The fuel valve is located under the fuel tank. This valve must be fully open for proper operation of the tractor.

FUEL FILTER (Fig 4-2)

The fuel filter (A) is a disposable type in-line filter. It should be replaced when dirty. To replace, first shut off in-line valve under fuel tank, then remove filter from the fuel line.

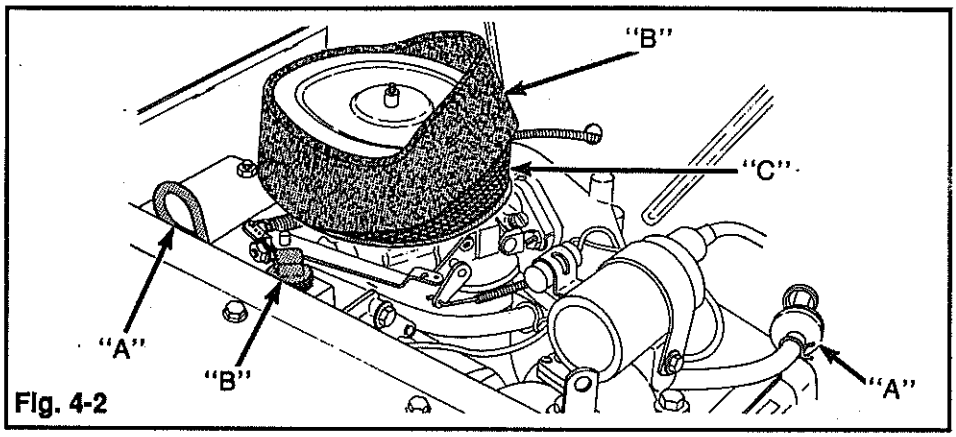


Fig. 4-2

Replace with Bolens part number 1727491.

AIR CLEANER

THE IMPORTANCE OF PROPER AIR CLEANER MAINTENANCE CANNOT BE OVER-EMPHASIZED!

IMPROPER AIR CLEANER MAINTENANCE CAN CREATE ENGINE DAMAGE WHICH THE ENGINE MANUFACTURER WILL NOT WARRANT!

AIR CLEANER DISASSEMBLY

1. Clean off any dirt or debris from around the air cleaner.

2. Remove air cleaner cover.

3. Remove pre-cleaner (B), Figure 4-2 and paper element (C).

PRE-CLEANER

Service pre-cleaner every 25 hours or more often under extremely dirty or dusty conditions.

Remove foam pre-cleaner by sliding it off the paper cartridge.

Wash foam pre-cleaner in liquid detergent and water.

Wrap foam pre-cleaner in cloth and squeeze dry.

Saturate foam pre-cleaner in engine oil. Squeeze to distribute and remove excess oil.

Install foam pre-cleaner over paper cartridge. Reassemble cover and screw down tight.

AIR FILTER CLEANING

Under normal operating conditions: disassemble and service air cleaner components every 25 hours of operation. Do this more frequently if extremely dusty or dirty conditions prevail.

PAPER ELEMENT

While servicing air cleaner, be careful that dirt is not allowed to fall into the engine. The dry type element is cleaned by gently tapping on a flat surface. Be careful, when doing this, not to damage gasket surfaces on element.

Wipe dirt or dust accumulation from air cleaner cover, including base plate. Dry type elements should be replaced when they are no longer serviceable.

CAUTION

PETROLEUM SOLVENTS ARE NOT TO BE USED TO CLEAN AIR CLEANER ELEMENT, AS THEY MAY CAUSE DETERIORATION OF THE ELEMENT MATERIAL. DO NOT USE PRESSURIZED AIR.

DO NOT OIL ELEMENT. OILING ELEMENT WILL EFFECT THE PAPER IN THE ELEMENT AND THEREFORE, ITS PERFORMANCE. USE ONLY A KOHLER ELEMENT.

CARBURETOR

The carburetor is designed to deliver the correct fuel-to-air mixture to the engine under all operating conditions. The main fuel and idle fuel adjusting needles on adjustable jet carburetors are set at the factory and normally do not require adjustment. If a black exhaust is noted, check the air cleaner first. An "over-rich " mixture is usually caused by a clogged air cleaner element, not an improperly adjusted carburetor. If, however, the engine is hard starting or does not operate properly, it may be necessary to adjust or service the carburetor. Refer to the engine manual supplied with your tractor or contact your local dealer.

AN INCORRECT CARBURETOR SETTING CAN LEAD TO FOULED SPARK PLUGS, OVERHEATING, EXCESSIVE VALVE WEAR, OR OTHER PROBLEMS. REFER TO THE ENGINE MANUAL PROVIDED OR SEE YOUR LOCAL DEALER FOR ASSISTANCE.

SPARK PLUGS (Fig. 4-3)

Remove plug(s) every 100 hours and inspect. Good operating conditions are indicated if plug has a light gray or tan deposit. A dead white or blistered coating could indicate overheating. A black (carbon) coating could indicate an "over-rich" fuel mixture caused by a clogged air cleaner or improperly adjusted carburetor. Do not service plugs in poor condition--best results are obtained if replaced with new plugs. Set gap at .025 inch (0.65 mm).

NOTE

CLEANING OF SPARK PLUGS IN MACHINES THAT USE ABRASIVE GRIT IS NOT RECOMMENDED. SPARK PLUGS SHOULD BE CLEANED BY SCRAPING OR WIRE BRUSHING AND WASHING WITH A COMMERCIAL SOLVENT.

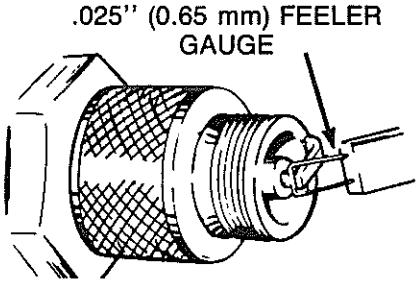


Fig. 4-3

FUEL SYSTEM (Continued)

TROUBLE SHOOTING GUIDE
DIESEL ENGINES
Models 5117H

PROBLEM	PROBABLE CAUSE	REMEDY
Hard starting	1. Fuel filter clogged.	1. Replace.
	2. Air in the fuel system.	2. Bleed system.
	3. Fuel tank is empty.	3. Refill and bleed system of air.
	4. Poor quality fuel.	4. Drain and refill.
	5. Injection nozzles dirty.	5. Have nozzels tested.
	6. Water in fuel system.	6. Clean system and refill with clean fuel.
	7. Dirty air filter.	7. Clean or install new filter.
Engine stalls during operation	1. Fuel tank is empty.	1. Refill and bleed system of air.
	2. Fuel filter is clogged.	2. Replace.
	3. Fuel pump is damaged.	3. Replace
Engine runs irregularly	1. Fuel filter is clogged.	1. Replace.
	2. Fuel pump is damaged.	2. Repair.
	3. Governor setting mal-functioning.	5. Check and adjust.
	4. Dirty air filter.	6. Clean or install new filter.

NOTE

Refer to Mitsubishi Diesel Engine Service Manual (Model L-3-A) for complete engine service information.

FUEL SYSTEM (Continued)

SERVICING DIESEL ENGINES

TYPICAL FUEL FLOW DIAGRAM

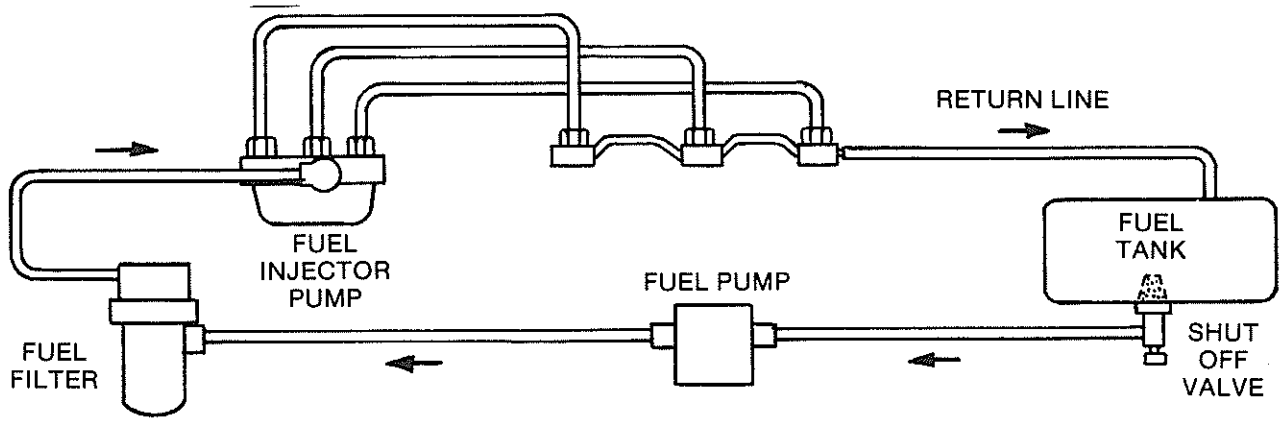


Fig. 4-4

FUEL TANK

Fill with a good, clean, fresh, seasonal grade of diesel fuel.

CAUTION

REFUEL OUTDOORS. DO NOT REFUEL WHILE ENGINE IS RUNNING. ALLOW ENGINE TO COOL BEFORE REFUELING AFTER IT HAS BEEN STOPPED .

Check to see that vent hole in fuel tank cap is not plugged.

FUEL VALVE

The fuel valve is located under the fuel tank. This valve must be fully open for proper operation of the tractor.

FUEL FILTER (Fig. 4-2)

The fuel filter is a disposable type , in-line filter, that should be replaced when dirty or every 400 hours. To replace, first shut off in-line valve under fuel tank, then remove filter from the fuel line. Replace with Bolens part number 1850128.

BLEEDING AIR FROM FUEL SYSTEM (Fig. 4-5)

Avoid running out of fuel. This can put air into the fuel system, which will then have to be bled out. Air in the fuel system prevents the engine from starting.

To bleed the fuel system of air, first turn the ignition switch to "ON". This will activate the fuel transfer pump.

Next, loosen air vent screw (C) on the fuel filter, which will allow fuel mixed with air out of the system (air will vent out of the system in the form of "bubbly" fuel).

When bubbles no longer come out of the vent hole, re-tighten the air vent screw (C).

Repeat the same procedure at air vent screw (D) on the fuel filter and air vent screw (E) on the fuel injection pump, in that order.

Be sure each air vent screw is re-tightened before you loosen any others.

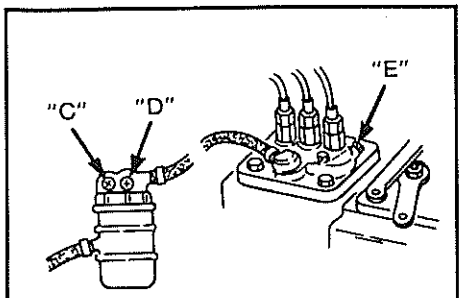


Fig. 4-5

FUEL INJECTION PUMP AND NOZZLES

DO NOT ATTEMPT REPAIR ON THESE ITEMS. CONTACT YOUR NEAREST AUTHORIZED BOLENS DEALER FOR REPAIRS.

AIR FILTER

Under normal operating conditions, disassemble and clean air cleaner element every 100 hours and replace every 400 hours. Do this more often if extremely dusty or dirty conditions prevail.

Remove element from air filter canister. Clean by gently tapping on the palm of your hand.

SERVICING
DIESEL ENGINES (Continued)

This element can also be cleaned in a low or non-sudsing detergent and warm water solution. Rinse with flowing water from inside out until water runs clear. Allow element to air dry thoroughly before using.

DO NOT USE COMPRESSED AIR TO DRY ELEMENT.

CAUTION

DO NOT OPERATE THE ENGINE WHILE THE AIR CLEANER ELEMENT IS REMOVED. UN-FILTERED AIR WILL CAUSE POWER LOSS AND SHORTEN ENGINE LIFE.

STEERING ASSEMBLY

FRONT WHEEL ALIGNMENT (Fig. 5-1)

1. Remove ball joint from wheel spindle. Loosen locknuts (A). Adjust ball joint (B) until wheels are parallel to each other.

2. With arm (C) positioned approximately 15° to the rear, adjust drag link (D) until wheels are parallel to the frame of the tractor.

FRONT AXLE ADJUSTMENT

An adjustment has been provided on the front axle to cut down on excessive vibration. By adjusting screws (E), pressure can be applied to the front axle. Raise front of tractor and adjust as required. Front axle should pivot with a small amount of drag.

STEERING ASSEMBLY (non-power assist)

The term right hand is determined by sitting on the tractor seat facing forward.

DISASSEMBLY (Fig. 5-2)

1. Open hood and left side panel.

2. Disconnect negative (-) battery cable from battery.

3. Remove the steering wheel by removing the hex nut (A), washer and woodruff key. Save for re-assembly.

4. Remove drag link (B) at steering arm.

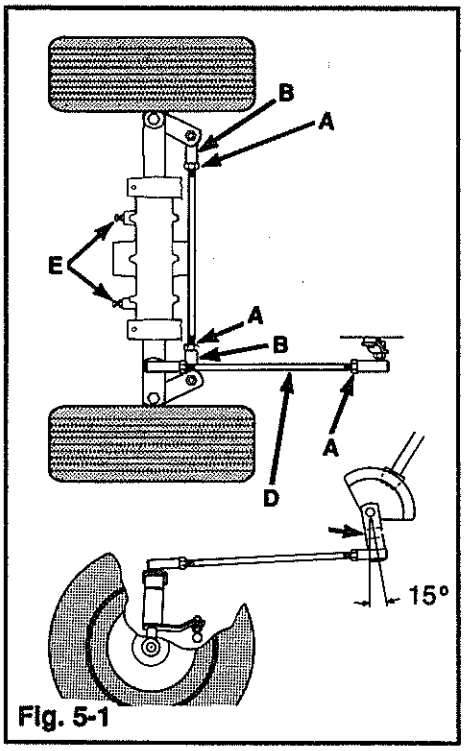


Fig. 5-1

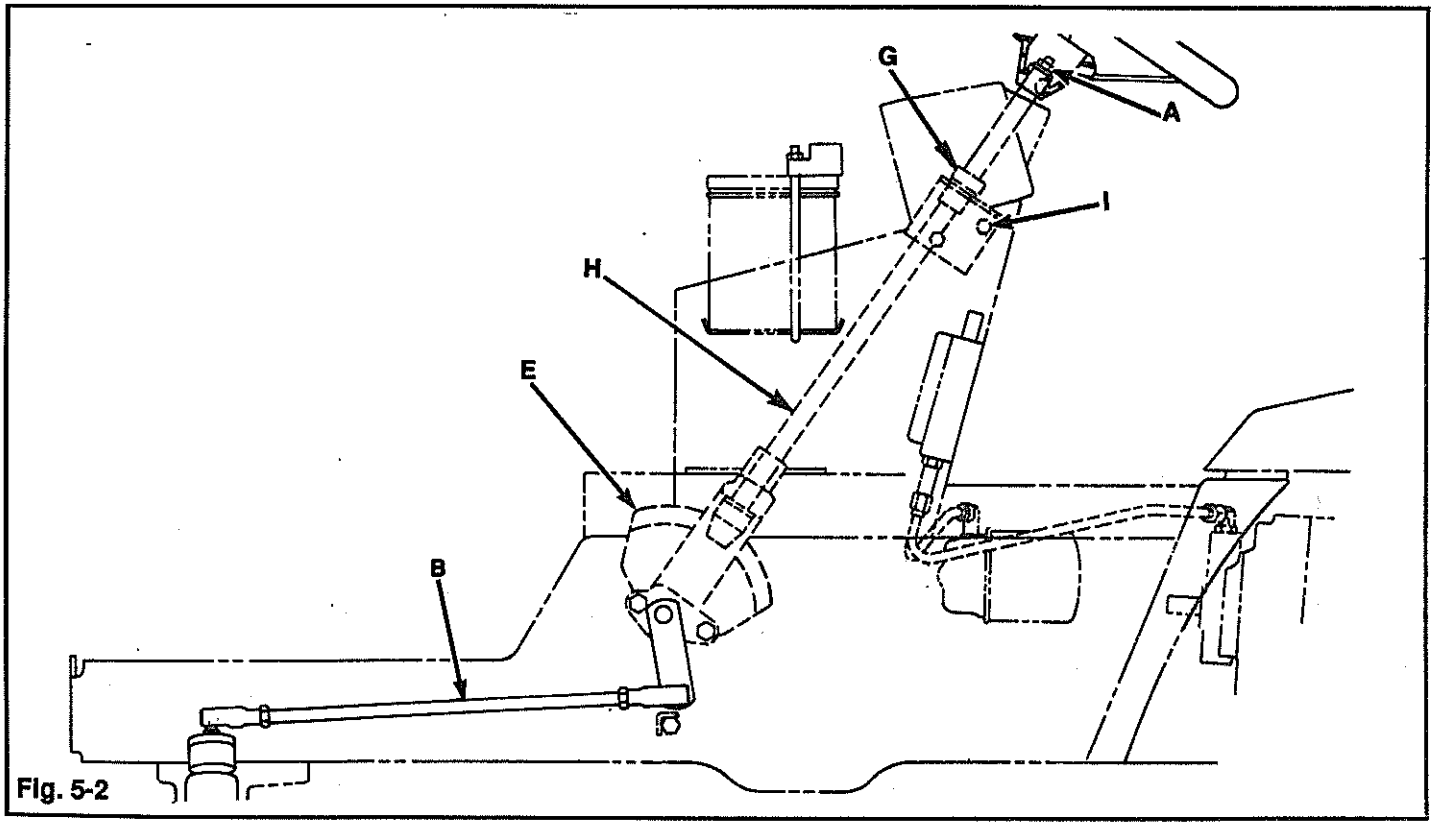


Fig. 5-2

CHASSIS (Continued)

STEERING ASSEMBLY (Continued)

(Figs 5-3 & 5-4)

5. Remove retaining ring (C, Fig. 5-3) and slide the steering arm assembly (D) out of the steering support bracket (E). Steering gear (F) will drop down at this time. ***NOTE: KEEP TRACK OF ALL SHIMS AND THEIR LOCATIONS DURING DISASSEMBLY. ITEMS MUST BE REASSEMBLED IN THE SAME MANNER.***

6. Loosen set screws in locking collar (G, Fig. 5-4) and remove steering shaft (H) by pushing down through steering support bracket (E). ***NOTE: IT MAY BE NECESSARY TO TAP THE STEERING SHAFT DOWN UNTIL THE FLANGE BUSHING (J, FIG. 5-2) CAN BE REMOVED FROM THE STEERING BRACKET.***

RE-ASSEMBLY

1. Install steering shaft (H) through steering support bracket (E) and steering column bracket (I). ***NOTE: BE SURE BEARING LOCKING COLLAR (G) IS IN PLACE AT THIS TIME.***

2. Remove steering shaft end play and tighten locking collar (G).

3. Apply never-seize to the steering shaft. Install woodruff key, steering wheel, washer and nut (A) removed in step 3, **DISASSEMBLY.**

4. With the steering wheel positioned correctly, position steering gear (F) in steering support bracket (E).

5. Install the steering arm assembly

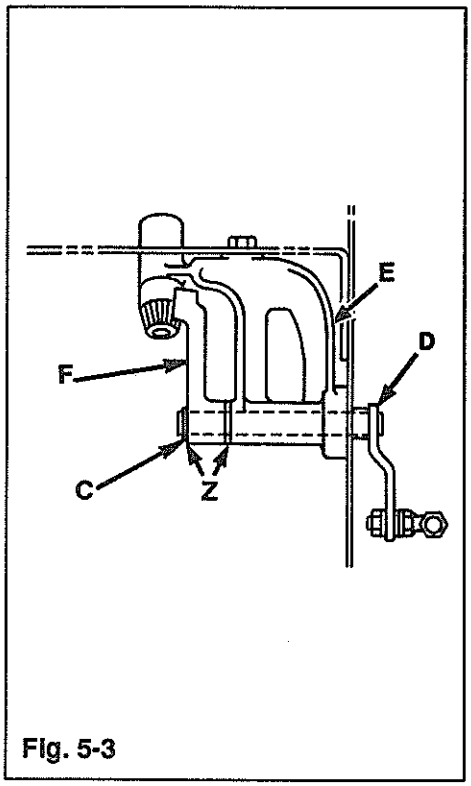


Fig. 5-3

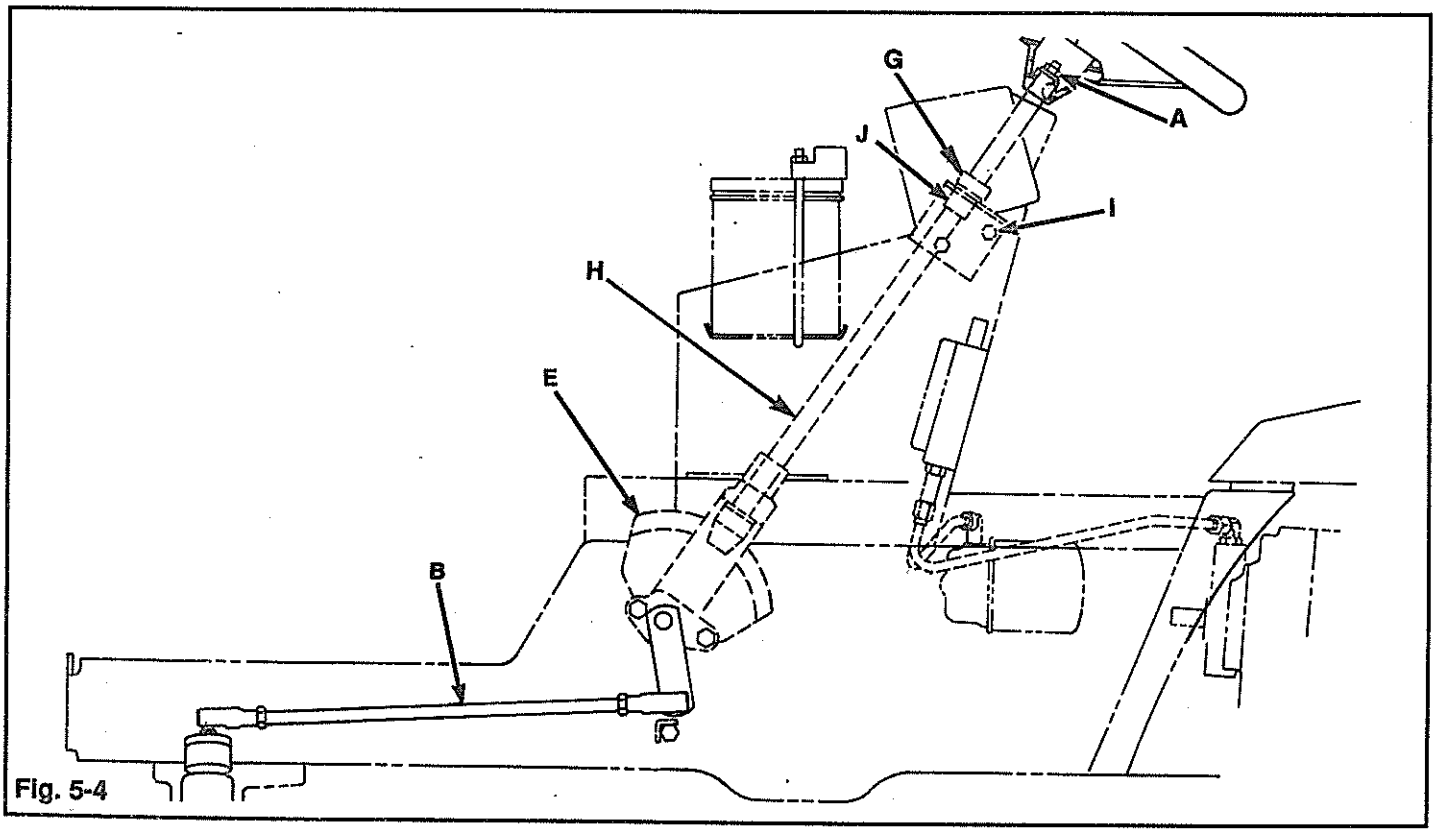


Fig. 5-4

STEERING ASSEMBLY (Continued)

(D) into the steering support bracket (E) with the steering arm assembly positioned approximately 15° to the rear. Add shims and install retaining ring (C).

6. Turn steering wheel to check for binding. Add or remove shims (Z, Fig. 5-3), as needed, for smooth and proper gear engagement.

7. Re-install drag links (B).

8. Re-connect negative (-) battery cable.

SEE PAGE 5-4, FIG. 5-6 FOR AN EXPLODED VIEW OF THE FRONT AXLE ASSEMBLY.

STEERING ASSEMBLY (power assist)
(Fig. 5-5)
NOTE: TO REMOVE THE POWER STEERING PUMP ONLY, GO TO STEP 5.

The terms right and left hand is determined by sitting on the tractor seat facing forward.

1. Open hood and both side panels.

2. Disconnect the battery relay from the battery support. Remove battery and battery support.

3. Remove 3/8" nut and flat washer (A) securing steering wheel in place. Remove steering wheel and woodruff key (B).

4. Remove locking collar (C) from steering shaft.

5. Remove drive pin (D) attaching steering shaft to steering pump (E). Slide shaft off pump.

6. Disconnect hydraulic lines from pump.

7. Remove pump form support by removing four (4) hex nuts and lock washers.

8. Remove pump from tractor.

9. Slide steering shaft down and out of column, only if repair is necessary.

10. Refer to section 6 , page 6-5 of this manual, **HYDRAULIC SYSTEM**, for steering pump and cylinder information.

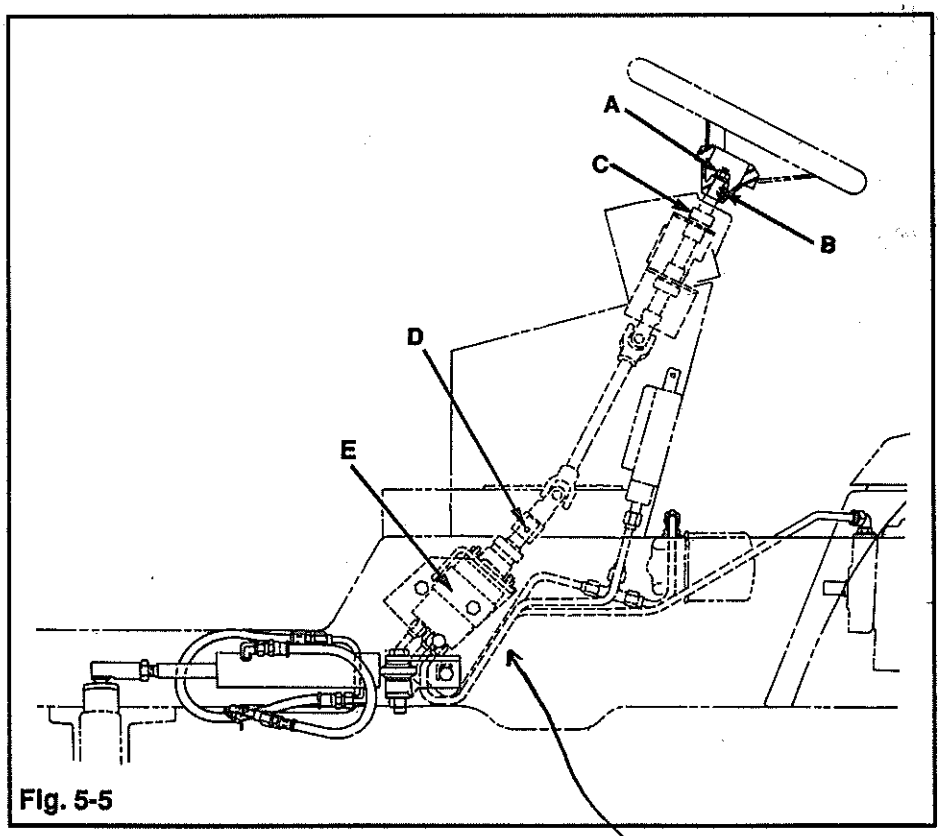


Fig. 5-5

Seal Kit
Ross or Parker
SK-000097
Greenville, TN
(423) 639-8151
Hanifin

CHASSIS (Continued)

STEERING ASSEMBLY (Continued)

LEGEND
FRONT AXLE ASSEMBLY

1. Front Axle
2. Tie Rod
3. L.H. Hand Ball Joint
4. R.H. Ball Joint
5. Nut, 1/2-20
6. Flange Bearing
7. Lock Nut, 1/2-20
8. Flat Washer
9. Woodruff Key
10. Grease Fitting
11. Spindle Ass'y
12. Steering Arm
13. Fl. Screw, 5/16-18 x 3/4
14. Retaining Ring

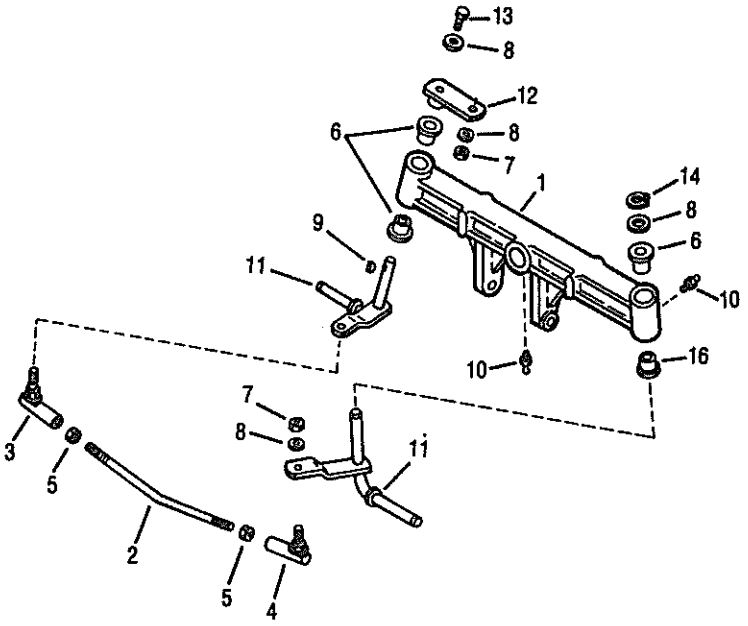


Fig. 5-6

FRONT WHEEL BEARINGS

(Fig. 5-7)
Front wheel bearings are pre-packed and sealed. They are to be replaced when they become worn or damaged.

1. Remove dust cap (A).

2. Remove retainer (B).

3. Remove wear washers (C).

4. Remove wheel from spindle.

5. Drive old bearings (D) out of wheel with a hammer and punch. Insert punch from opposite side for easier removal.

6. Install bearing into wheel hub. With a soft-faced hammer, tap bearing into place on the outer flange of the bearing.
NOTE: AVOID HITTING THE CENTER OF BEARING. THIS COULD DAMAGE THE BEARING.

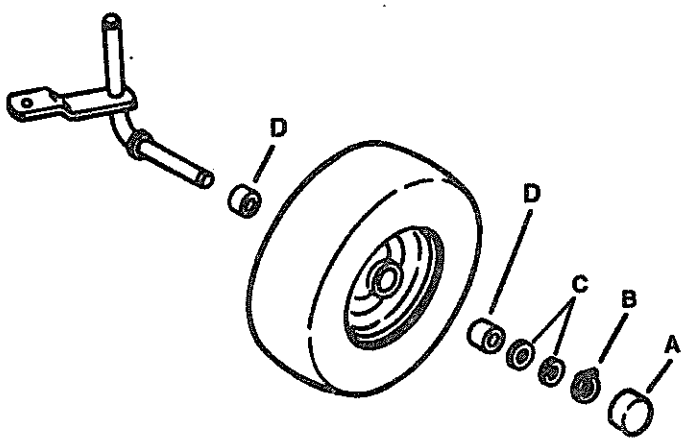


Fig. 5-7

STEERING ASSEMBLY (Continued)

PNEUMATIC TIRES

Check for proper tire inflation:

Front: 12 to 14 PSI (14 PSI with front mounted attachments)

Rear: 10 to 12 PSI

Make sure both front tires are inflated the same, and both rear tires are inflated the same. Check air pressure with a low-pressure gauge. ***NOTE: OPERATING WITH INCORRECT PRESSURES MAY DAMAGE TIRES.***

CHASSIS (Continued)

BRAKE ADJUSTMENTS

(5100 Series, Serial numbers 0299999 and earlier)

If it only requires light foot pressure to latch the parking brake, or if the parking brake does not hold the tractor when the brake pedal is latched, the brake system requires adjustment.

With the parking brake released, proceed as follows:

1. Turn hex nut (A. Fig. 5-8) and lock nut on inside of bracket until a gap of .010" (.25mm) is achieved between brake disc and brake pad.

With brake/neutral pedal fully released, brake disc must rotate freely.

The tractor should not move when the brake/neutral pedal is locked in the FIRST position of the parking brake lever.

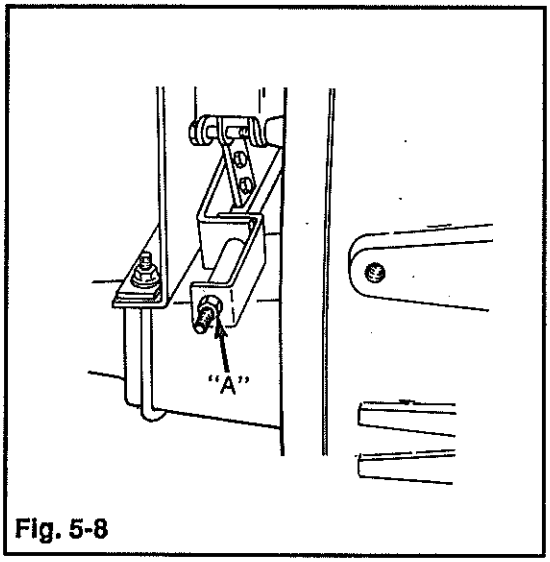


Fig. 5-8

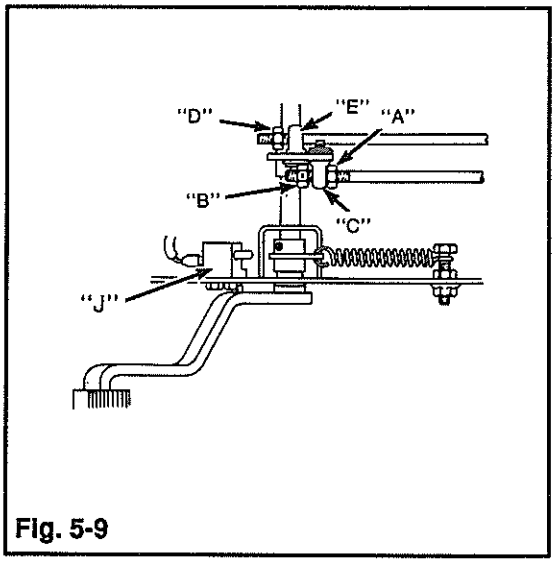


Fig. 5-9

BRAKE ADJUSTMENTS (Continued)

(5100 Series, Serial Numbers 0300101 and later)

(Figs. 5-10 & 5-11)

1. Remove pin (H, Fig. 5-11) and drop brake yoke (J) down.

2. Tighten or loosen bolts (F) on brake caliper **equally** until there is a 1/4" to 1/2" play at the lower hole in brake arm (I). (Tightening bolts (F) lessens amount of play; loosening increases play).

3. Rotate brake yoke (J) until hole for pin (H) lines up with corresponding hole in brake arm with arm pushed forward taking up the 1/4" to 1/2" slack set in step 2.

4. Re-install pin (H) through brake yoke (J) and lower hole in brake arm (I). There will be a slight drag on brake disc (G) after this adjustment is made.

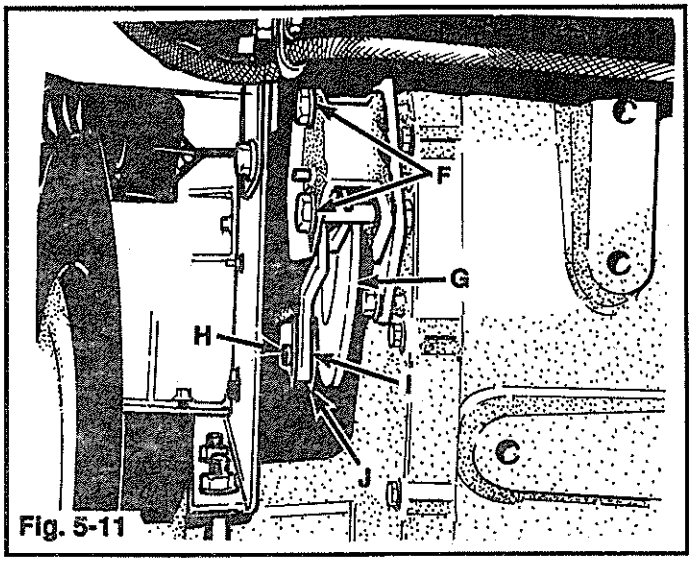


Fig. 5-11

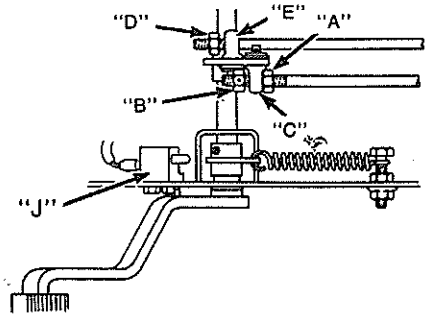


Fig. 5-12

HYDROSTATIC DRIVE ADJUSTMENTS

HYDROSTATIC MAINTENANCE

With the transmission cold and the engine off, check the fluid in the transmission reservoir. It should be to the level indicated on the dipstick.

HYDROSTATIC PEDAL ANGLE ADJUSTMENT

The hydrostatic pedal angle was adjusted at the factory. It is set at about a 45° angle. This angle can be changed, if desired, as follows:

(Fig. 5-15)

1. Loosen hex nuts (A).

2. Adjust hex nuts until desired angle is reached.

3. Re-tighten hex nuts (A) against pivot (B).

HYDROSTATIC NEUTRAL ADJUSTMENT

The hydrostatic neutral is adjusted at the factory. If the tractor creeps forward or backward while hydrostatic pedal is in the neutral position, adjustment is required. Adjust hydrostatic neutral as follows:

1. Securely block up rear of tractor so the rear wheels clear the ground.

2. Remove the tractor chassis tunnel by removing the four (4) mounting screws.

3. Start the engine and release the brake.

4. Loosen capscrews (C), and move support plate (D) forward if the wheel rotate in a forward direction, or toward the rear if the rotate in reverse.

5. Tighten capscrews securing support plate (D) when wheels no longer rotate.

6. Stop engine and lock brake arm against the stop (E).

7. Loosen jam nuts (F), and turn rod (G) until pin enters slot (H) of neutral plate. Adjust until there is a gap of 1/32" between end of slot and pin.

NOTE: INCORRECT ADJUSTMENT MAY CAUSE PIN BREAKAGE.

8. Tighten jam nuts (F).

9. Re-install tunnel.

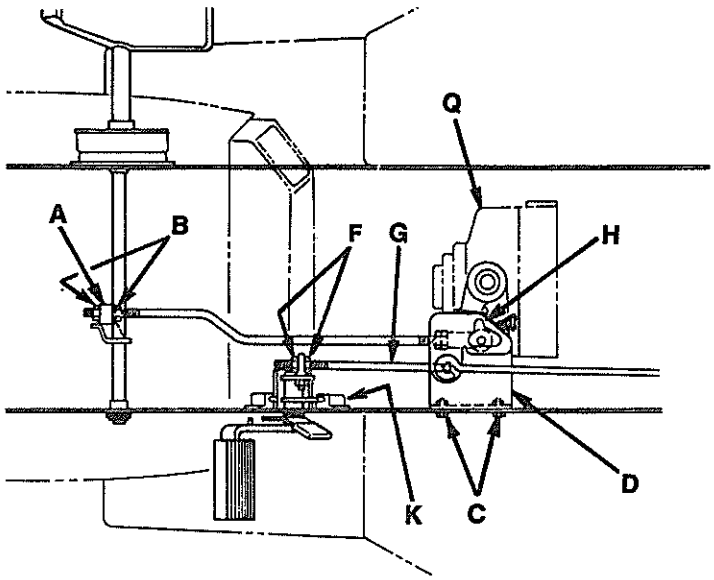


Fig. 5-15

INTERLOCK SWITCHES

INTERLOCK SWITCHES

This unit is equipped with INTERLOCK SAFETY SWITCHES. the function of these safety switches is to insure SAFE START-UP of the unit.

(ALL MODELS EXCEPT 5117)

1. One interlock switch is incorporated into the Attachment Drive Switch. This switch must be turned off to start the engine.

(ALL MODELS)

2. The second switch is positioned inside the seat and it requires no adjustment. If the operator leaves the seat without locking the brake / neutral pedal and turning off the PTO switch, the engine will stop. (on Model 5117H, the mower will stop).

3. The third switch (J) is on the brake / neutral linkage. It must be depressed by pushing down on the brake / neutral pedal to start the engine.

4. The fourth switch (K) is also on the brake / neutral linkage. When the pedal is depressed, the button of the switch is released and all power to the speed control is shut off.

CAUTION

ALL THESE SAFETY INTERLOCK SWITCHES SHOULD OPERATE AS DESCRIBED. IF THESE SWITCHES FAIL TO OPERATE, GET THE UNIT SERVICED IMMEDIATELY BY AN AUTHORIZED BOLENS DEALER. SEVERE INJURY COULD RESULT BY NOT FOLLOWING THIS PRACTICE.

PRINCIPLES OF OPERATION

The hydraulic system is made up of seven major components. These are: the hydrostatic transmission charge pump, power steering control valve, power steering cylinder, attachment lift valve, attachment lift cylinder, filter and all external lines and hoses. The source of the fluid flow is a roller type charge pump mounted on the hydrostatic package, which is driven by the engine. This charge pump provides hydraulic pressure. The fluid reservoir is the transmission and final drive housing. All flow is first routed through the power steering control valve.

POWER STEERING CIRCUIT

The power steering control valve is a rotary valve with a built-in 'hand pump', which allows manual steering if hydraulic power is lost. A function of this valve is to give priority flow to the the power steering circuit (See Fig. 6-1 Power steering valve flow schematic). When the steering is in the neutral position, no fluid flow to the steering cylinder is required. In this position, all fluid flowing to the steering valve through the 'IN' port, immediately flows out through the 'AUX' port, and to the attachment lift valve. Also while in this position, the valve isolates the 'RH' and 'LH' work ports which are connected to the steering cylinder, so the steering linkage remains in a fixed position. When the steering wheel is turned, the valve is rotated to allow flow to be diverted to one side of the steering cylinder, and to allow return from the opposite side. When the steering wheel is turned in the opposite direction, the valve is indexed so the fluid flow is reversed, resulting in cylinder movement in the opposite

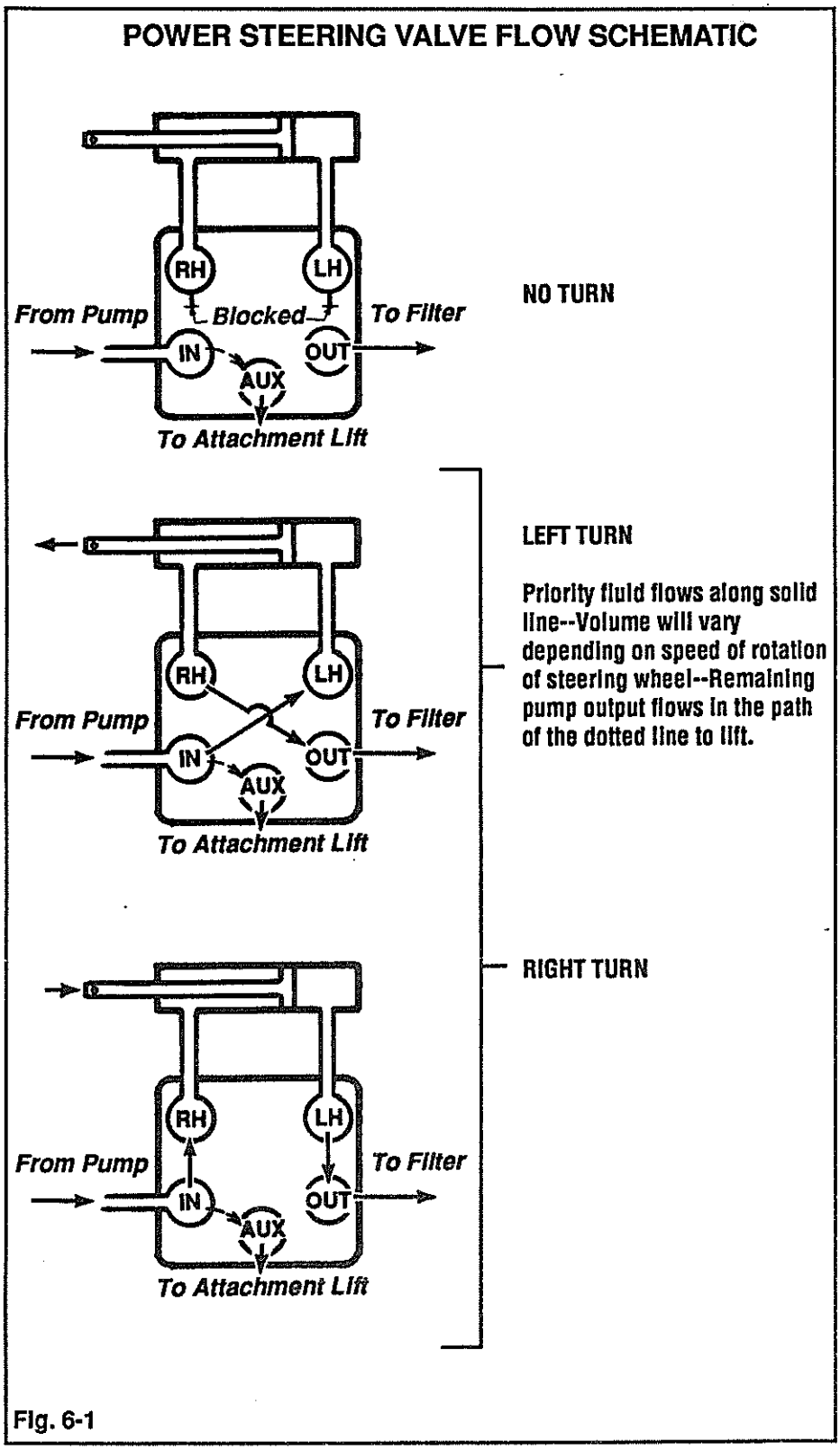


Fig. 6-1

PRINCIPLES OF OPERATION (Continued)

direction. Cylinder return fluid passes from the circuit beyond the attachment lift valve, therefore any loads placed on the basic circuit beyond the attachment lift have no affect on the power steering--which gives it priority over the lift circuit. Since return fluid from the steering cylinder is not routed to the lift valve, and all or a portion of the pump flow is directed to the steering cylinder, the lift cycle will be slower when the steering circuit is being activated. The valve is capable of regulating flow at any rate from zero to full pump output, depending on the speed at which the steering wheel is rotated, giving the operator steering feel whether making slight steering movements, or a full lock-to-lock turn.

ATTACHMENT LIFT CIRCUIT

The attachment valve is either a single, or two-spool, open-center valve, depending on the tractor model (See Fig. 6-2 lift valve flow schematic). Fluid may be directed to either the attachment lift cylinder, or an auxiliary hydraulic load (actuator), by shifting a spool with a control lever. As the spool moves within the valve body, a series of lands on the spool and ports in the body act as "gates" to direct the fluid to the desired circuit, and allow the return of fluid from the actuator. In the 'neutral' position, fluid from the pump flows directly through the valve open-center passages from the 'IN' port to the 'OUT' port, while "work" ports connected to the actuators are blocked by the spool lands. Shifting the attachment lift spool to the 'raise' position diverts pump flow to one side of the double-acting lift cylinder, while return flow from the opposite side of the cylinder flows back into the valve and exits the 'OUT' port. The result is

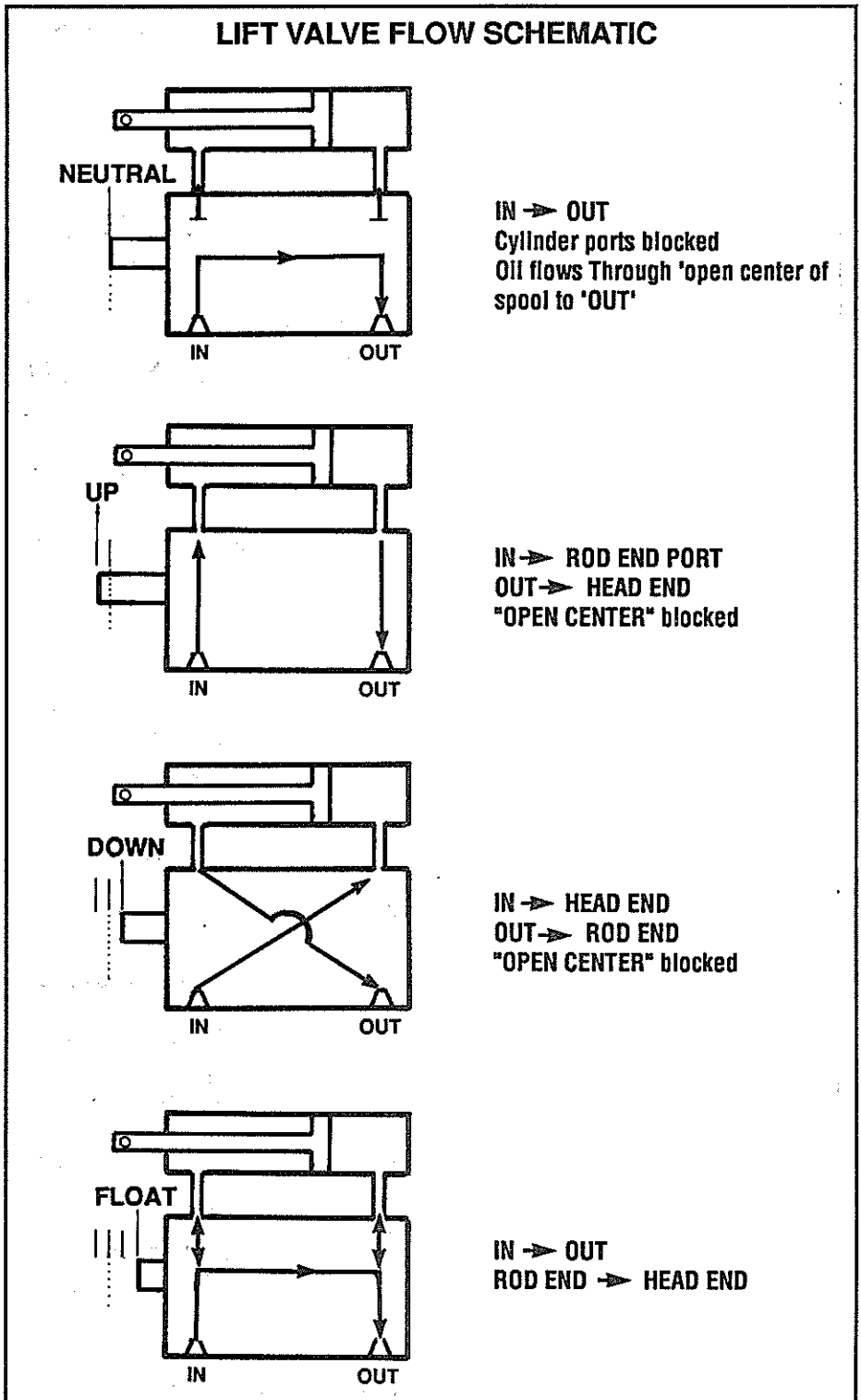


Fig. 6-2

PRINCIPLES OF OPERATION (Continued)

retraction of the cylinder rod into the cylinder barrel. Moving the spool the opposite direction to the 'lower' position causes the same flow pattern to repeat, except that flow to and from the cylinder is in the opposite direction, which results in the cylinder rod extending from the cylinder barrel. The function of the auxiliary valve in these three positions is the same as the attachment lift valve. An additional 'float' position is added to the attachment lift spool, which in effect, connects the 'IN, 'OUT' and both work ports through the open-center passages to allow free flow of fluid to and from the cylinder so the cylinder rod is allowed to "float" in or out depending on the movement of the attachment lift linkage. A detent holds the spool in this position so the operator is not required to manually hold the control lever in 'float'.

An important point in this description, is that in all operating positions, fluid flow is maintained through the 'OUT' port and on to the remainder of the hydraulic system. This flow may be free flow in 'neutral' or cylinder return fluid in either of the work positions.

When the fluid passes from the attachment lift valve, it then flows to the hydraulic filter. The filter is located immediately ahead of the hydrostatic transmission to provide complete filtering of the fluid prior to entering the charge portion of hydrostatic unit, where clean fluid is a major requirement. The operating characteristics of the hydrostatic are such that a deficiency of charge fluid will result in a noticeable loss of performance, whereas introduction of contamination would result in permanent damage before the operator would be aware of any change in performance. Therefore, the filter has no provision for a filter bypass, which could allow contamination to enter the unit. ***THIS EMPHASIZES THE IMPORTANCE OF USING ONLY GENUINE BOLENS REPLACEMENT FILTERS, VERSUS A GENERIC SUBSTITUTE, WHICH MAY HAVE AN BUILT-IN BYPASS VALVE..***

The final component in the basic hydraulic circuit is the hydrostatic transmission, specifically the charge portion of the unit. The charge circuit provides fluid to the low pressure side of the drive pump and motor loop to replace fluid which is lost due to internal leakage. (See section 3, page 3-2 for additional information). A positive pressure must be maintained in the charge circuit to assure fluid makeup. A regulator valve is incorporated into the hydrostatic which establishes a permanent back-pressure of 120-160 PSI in the system. This back-pressure is maintained at the last component in the basic hydraulic circuit, therefore, any pressure readings in the circuit should have a minimum reading of 120-160 PSI at full engine speed.

HYDRAULIC SYSTEM (Continued)

TROUBLE SHOOTING GUIDE

*Refer to the following pages for test procedures

SYMPTOM	charge pressure regulator set too high	low oil level	Water in oil	failed final drive components	failed drive shaft or key	plugged filter	load too heavy	oil viscosity too heavy	linkage not activating control	charge pump malfunction	lift cylinder leakage	control valve malfunction	inherent system characteristic	suction leak	operating at low engine speed	failed cooling fan, plugged cooling fins	oil viscosity too thin	improperly connected or defective quick coupling	power steering valve malfunction	power steering cylinder valve leakage	steering linkage out of adjustment	high internal leakage	Test Procedure*
No Hydraulic power at start-up		●			●			●	●	●				●									1,3
Rough or jerky hydraulic at start-up		●						●		●				●									1,3
Rough or jerky hydrostatic at start-up		●				●		●	●	●				●									1,2,3
Low hydrostatic power when cold		●				●		●		●				●	●								1,2,3
Low hydraulic power when cold		●				●	●	●		●	●	●			●								ALL
Low hydraulic power when hot		●	●				●			●	●	●					●						ALL
Low hydrostatic power when hot		●	●				●			●					●		●						1,2,3
Rough or jerky hydraulics when hot		●	●							●				●									ALL
Rough or jerky hydrostatic when hot		●	●	●					●	●				●			●						1,2,3
Hydraulic system unable to lift load		●			●	●	●		●	●	●	●		●			●						2–5
Hydraulic system lifts load slowly		●				●	●	●	●	●	●	●		●	●		●						ALL
Load drops when valve in neutral											●	●											5
Inoperative or slow auxiliary circuit operation							●		●			●						●					
Low power in steering circuit, hard steering		●				●	●	●		●				●	●		●		●	●			1,2,3,5
Steering 'wanders' during operation		●												●					●	●			1,5
Steering pulls to either or both directions																			●	●	●		3,5
Excessive hydraulic line vibration		●	●							●				●									1,3
Hydraulic fluid overheats		●	●			●	●							●	●	●	●					●	
Lift actuates when in 'float' and auxiliary circuit is activated													●										
Pulsation in steering when lift actuated						●																	2
Hydraulic filter gasket or filter case ruptures	●					●		●															2
No manual steering operation immediately after shut-down														●					●				1
Lift slows when steering is activated	●									●			●										1,2,3
Left turn steering action slower than right													●										
Erratic rate of steering movement, jerky steering		●						●		●				●					●		●		1,3
Pulsation in hydrostatic control pedal		●				●	●		●					●			●						1,2,3
Noisy hydraulic or hydrostatic when hot		●								●				●	●		●						1,3
Oil 'boiling'			●																			●	

HYDRAULIC SYSTEM TEST PROCEDURES (Continued)

TEST PROCEDURE NO. 5 (Fig. 6-4),
HYDRAULIC CYLINDER INTERNAL LEAKAGE TEST

CAUTION

CAUTION SHOULD BE EXERCISED WHEN PERFORMING THIS TEST. IT IS PERFORMED WITH OPEN CONNECTIONS WHICH COULD EMIT LARGE VOLUMES OF FLUID IF EXTREME CYLINDER LEAKAGE IS PRESENT OR THE CONTROL IS MOVED TO THE WRONG POSITION DURING STEP 5. WEAR EYE PROTECTION WHEN PERFORMING THIS TEST.

1. Move valve control to fully extend or retract the cylinder to be tested.

2. SHUT ENGINE OFF.

3. Remove the RETURN hydraulic hose from the cylinder barrel. See Figure 6-4.

4. Wrap the loose end of the hose with a shop towel to contain oil which may leak during test.

5. Start engine and activate valve control in the SAME DIRECTION AS step 1, holding pressure on the cylinder for 15-20 seconds and observing the open cylinder fitting.

6. Any sustained dripping from the open cylinder fitting indicates leakage around the internal sealing components.

7. If no leakage is observed, SHUT ENGINE OFF and connect the hose removed in step 3.

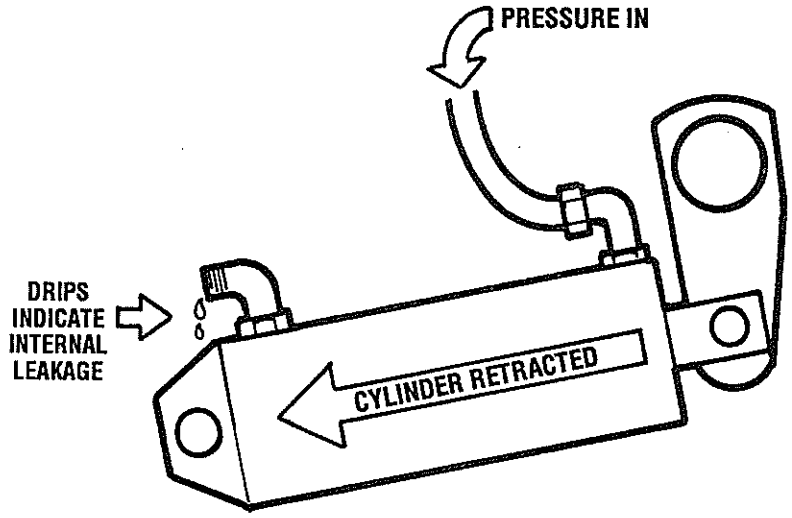


Fig. 6-4

8. Start engine and move control to position the cylinder in the opposite direction as in step 1.

9. Repeat steps 2 through 6.

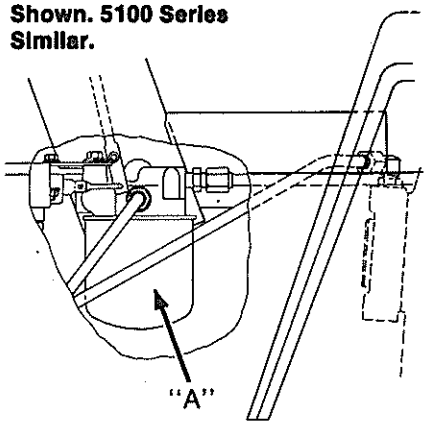
10. If leakage from the open cylinder fitting is observed in either test position, the cylinder must be disassembled and appropriate repairs performed.

NOTE: the 5100 Series power steering cylinder is non-repairable and must be replaced to correct internal leakage.

11. If no internal cylinder leakage is evident, remaining un-tested components, such as the control valve are suspect and should be evaluated.

HYDRAULIC SYSTEM (Continued)

HYDRAULIC FILTER



5000 Series Tractor Shown. 5100 Series Similar.

Fig. 6-5

HYDRAULIC FILTER

The spin-on type filter (A, Fig. 6-5—Bolens part # 1726450) is located under the battery and fuel tank support.

When replacing the filter, apply a small amount of oil to the filter gasket. Hand tighten the filter.

IMPORTANT

USE ONLY GENUINE BOLENS REPLACEMENT FILTERS. SUBSTITUTE FILTERS MAY HAVE AN BUILT-IN BYPASS VALVE WHICH COULD DAMAGE THE HYDRAULIC SYSTEM (See Page 6-3).

HYDRAULIC POWER LIFT

REPAIRING THE HYDRAULIC LIFT CYLINDER, (Fig. 6-6)

To remove the piston rod assembly (A) from the cylinder, the internal snap ring (B) and the hose fitting, which goes through hole (C) in the cylinder tube, must be removed.

PISTON ROD REMOVAL

1. Remove 90° elbow from cylinder tube.
2. Pull the piston rod out until is is fully extended.
3. Pinch snap ring together and pull on piston rod until the assembly slides out of the cylinder housing.

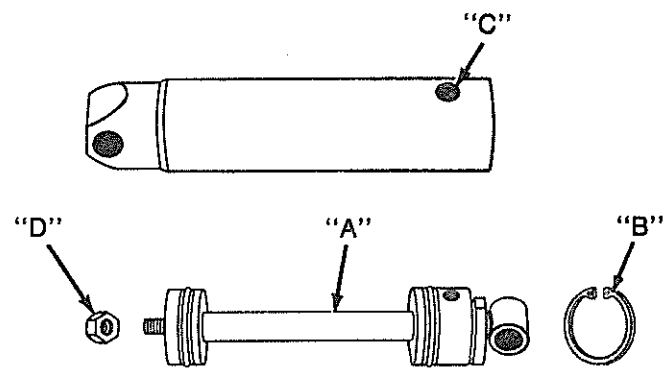


Fig. 6-6

HYDRAULIC SYSTEM TEST PROCEDURES

CAUTION

CARE SHOULD BE TAKEN TO THOROUGHLY INSPECT ALL HYDRAULIC COMPONENTS FOR HIGH PRESSURE LEAKS BEFORE TESTING OR REPAIRING. NEVER 'FEEL' FOR LEAKS, AS OIL LEAKING AT HIGH PRESSURE HAS SUFFICIENT FORCE TO PENETRATE THE SKIN AND CAUSE SERIOUS INJURY. USE EXTREME CARE WHEN WORKING WITH A SYSTEM AT OPERATING TEMPERATURES AS SEVERE BURNS CAN BE CAUSED BY CONTACT WITH HOT FLUIDS.

The following procedures can be used as a basic troubleshooting method in their entirety, or can be used selectively based on reference from the troubleshooting chart. Prior to proceeding with any test, the fluid level should be checked and adjusted to correct levels. Fluid samples should also be checked for contamination, such as: metallic particles, A strong 'burnt' odor (which would indicate over-heating--the result of overloading), excessive tolerances, reduced flow of cooling air, or lack of cooling fin maintenance, A milky appearing fluid indicates moisture in the system.

Any of these fluid conditions can only be corrected by replacement of the fluid and a flushing of the system with clean fluid prior to resuming further testing or operation. The presence of foam in the fluid or reservoir is a sign of air in the hydraulic system, which is the result of a leak in the suction section of the pump and connections, or a high pressure internal leak.

BASIC TROUBLESHOOTING PROCEDURE

1. Check fluid level.

2. Check for metallic contamination in fluid.

3. Smell for burnt odor or signs of overheating.

4. Check fluid for milky appearance.

5. Check fluid and reservoir for presence of foam.

See Section 3 of this manual for repair procedures indicated for charge pump or any other hydrostatic component repairs.

***TEST PROCEDURE NO. 1,* SUCTION LEAK TEST**

Suction leaks generally will result in a pause in hydraulic function at start up, or foaming of the hydraulic fluid. If a suction leak is being checked, make sure this test is performed after sufficient time is allowed after shut-down to allow the malfunction to occur.

1. Remove dipstick from fill tube.

2. Tightly wrap a clean shop towel around the tip of a compressed air nozzle.

3. Place the nozzle into the fill tube, allowing the towel to partially seal the opening. DO NOT ALLOW A COMPLETE SEAL AS EXTREME PRESSURE COULD DAMAGE GASKETS OR SYSTEM SEALS.

4. Apply pressure to the reservoir as an assistant starts the unit.

The effect of a suction leak will be diminished as the air pressure forces fluid into the charge pump, resulting in a rapid pickup of hydraulic function, or smoothing of rough operation.

5. Check suction tubes and fittings for restrictions before internal repairs are attempted.

6. Sources of suction leaks are: external connections, charge pump seals and "O"-rings, or charge pump wear in hydrostatic.

***TEST PROCEDURE NO. 2* SYSTEM BACK, PRESSURE TEST**

1. Connect a 1000 PSI minimum pressure gauge into the charge pump outlet with a TEE as illustrated in Figure 6-3

2. Start the engine and run the unit for 5-10 minutes to allow the system to warm up and stabilize.

3. Check pressure at full engine RPM. Pressure should read from 120-160 PSI with no loads on system in lift or steering circuits.

4. A high pressure reading indicates an abnormal system back-pressure which would oppose power steering or lift operating pressure and result in poor performance in those circuits.

5. Probable causes of high back-pressure are: plugged filter, incompletely drilled fittings, bent or kinked lines or tubes, charge pressure regulator malfunction in hydrostatic, internally ruptured filter element or poor charge pump performance.

HYDRAULIC SYSTEM TEST PROCEDURES (Continued)

***TEST PROCEDURE NO. 3,* STEERING SYSTEM AND CHARGE PUMP PRESSURE TEST**

1. Connect a 1000 PSI minimum pressure gauge into the charge pump outlet with a TEE as illustrated in Figure 6-3.

2. Start the engine and run the unit for 5-10 minutes to allow the system to warm and stabilize.

3. Turn the steering wheel completely to the right and hold while observing pressure.

4. Turn the steering wheel completely to the left and hold while observing pressure.

5. A pressure reading of 800 PSI minimum while the steering wheel is held in these extreme positions indicates a charge pump in good condition.

6. Go to ***TEST PROCEDURE NO. 4*** if reading is less than 800 PSI.

***TEST PROCEDURE NO. 4,* MAXIMUM REGULATED SYSTEM PRESSURE TEST**

Connect a 1000 PSI minimum pressure gauge into the charge pump outlet with a TEE as illustrated in Figure 6-3.

2. Start the engine and run the unit for 5-10 minutes to allow the system to warm and stabilize.

3. **(5117H & 5120H)** Disconnect auxiliary circuit connectors (if applicable) at quick couplers and move control to either position while observing pressure

(5118 H/HS) Move lift control lever to either position until cylinder reaches the end of its stroke. Observe pressure. Move lever to **opposite** position until cylinder reaches the end of its stroke. Observe pressure.

4. A pressure reading of 800 PSI minimum should be observed.

5. If test pressure is less than 800 PSI, and ***TEST PROCEDURE NO. 3*** was performed with satisfactory readings: (5117H & 5120H) The attachment lift valve could have high internal leakage or a low relief valve setting. (5118H/HS) Go to ***TEST PROCEDURE NO. 5*** to check attachment lift or auxiliary actuator for internal leakage.

MODELS 5117H & 5120H SHOWN

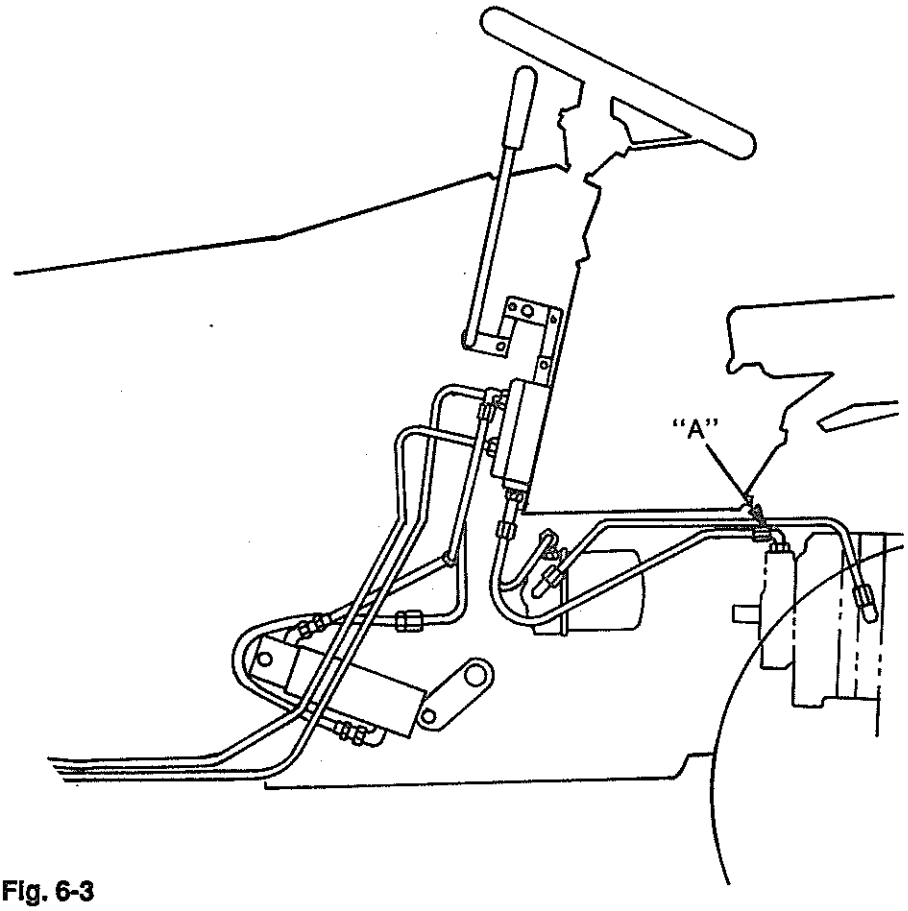


Fig. 6-3

HYDRAULIC POWER LIFT (Continued)

When the piston rod assembly is removed from the cylinder tube, the hex nut (D) can be loosened and the piston, cylinder head, and related "O"-rings and ring washers can be removed. All parts should be inspected and new "O"-rings installed. IMPORTANT: grease "O"-rings to prevent damage during assembly.

1. Piston Rod Assembly
2. Oil Seal
3. Snap Ring
4. Ring Washer
5. "O" Ring
6. Ring Washer
7. "O" Ring
8. Cylinder Head
9. Ring Washer
10. "O" Ring
11. Ring Washer
12. Piston
13. Cylinder Tube
14. Hex Nut

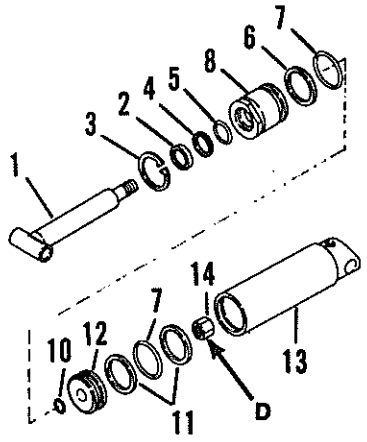


Fig. 6-7 HYDRAULIC CYLINDER BREAKDOWN

SINGLE-SPOOL VALVE REPAIR
MODEL 5118H

REPAIRING THE HYDRAULIC CONTROL VALVE (SINGLE SPOOL VALVE, FIG. 6-8)

The hydraulic control valve regulates and changes the direction of oil flow to the hydraulic cylinder when the control lever is actuated. "Lip Seals" are used on the spool to provide a seal in the bore.

Replacement lip seals are available for the control valve. Order Bolens part # 1754414.

DISASSEMBLY

The spool is matched to the bore in the valve body. If the spool or valve body is damaged the complete valve assembly must be replaced.
To remove the spool from the valve, remove the capscrew in the end of the spool, and flat washer. Remove the spool by pulling it out of the lever end of the valve body.

Small burrs and scratches can be removed from the spool with fine emery cloth. Clean all parts before assembly.

ASSEMBLY

1. Install new lip seal rings onto the spool with the opening towards the inside of spool.
2. Lubricate seals and insert spool with seals into valve body. Be careful not to damage seals. Install the spool into the valve body from the lever end. This end has a chamfer in the bore which is a lead for the packings.
3. Secure spool with round head screw, lock washer and flat washer.

SINGLE SPOOL VALVE

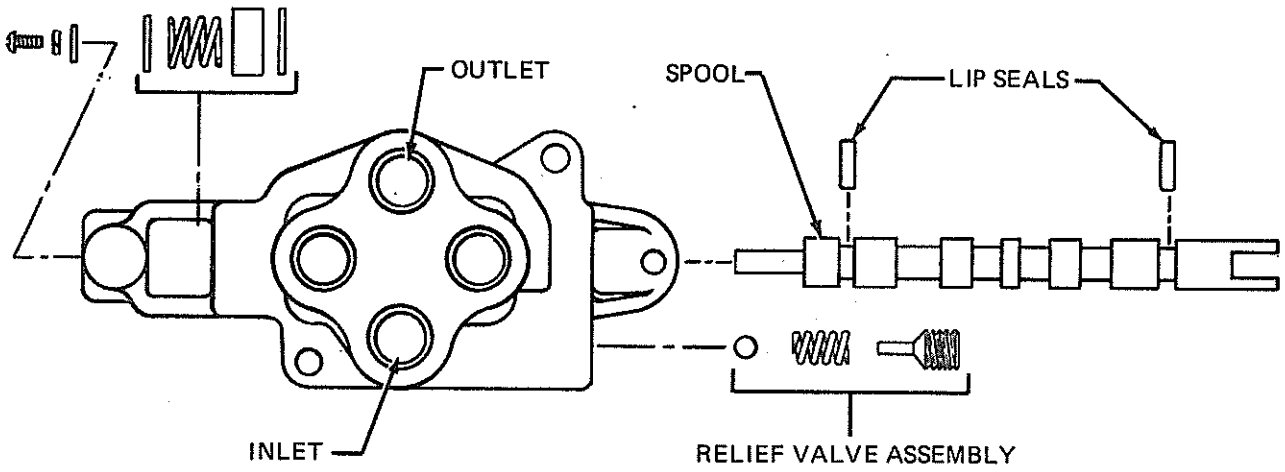


Fig. 6-8

TWO-SPOOL VALVE REPAIR
MODELS 5117H, 5118HS & 5120H

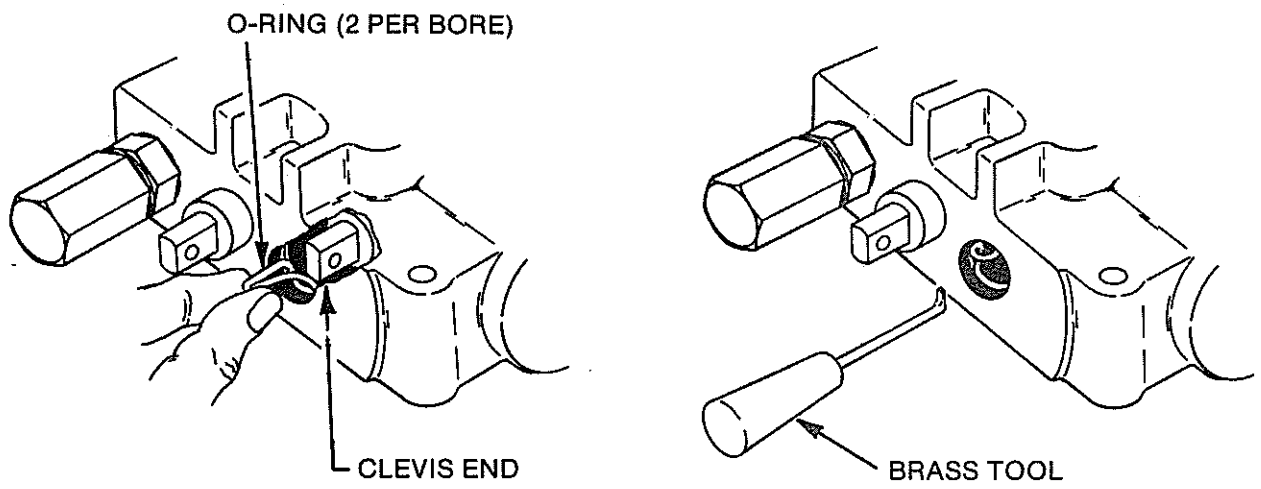


Fig. 6-9

REPAIRING THE HYDRAULIC CONTROL VALVE, (TWO SPOOL VALVE, FIG. 6-9)

The hydraulic control valve regulates and changes the direction of oil flow to the hydraulic cylinder when the control lever is actuated. "Lip Seals" are used on the spool to provide a seal in the bore.

Replacement lip seals are available for the control valve. Order Bolens part # 1754414.

DISASSEMBLY

The spool is matched to the bore in the valve body. If the spool or valve body is damaged, the complete valve assembly must be replaced.

1. Remove end cap assembly.

2. Remove valve spool from valve body. Using a brass tool (shown in Fig. 6-9)

3. Remove "O"-rings from valve body. Care must be taken not to scratch the bore and not contaminate the bore with any foreign matter. 4.

4. Clean and dry spool with a suitable solvent.

ASSEMBLY

1. Insert clevis end into back end of valve body until it is even with the back end of the "O"-ring groove on the front of the valve body.

2. Pinch lubricated "O"-ring so it can be inserted into body as shown. Take care that "O"-rings are not cut or nicked during installation.

3. Insert part of "O"-ring into groove and let loose. With a brass tool (as shown in Fig. 6-9), guide "O"-ring into groove.

4. Rotate spool, while pushing and pulling spool until back edge of spool is in line with back edge of "O"-ring groove on cap end of valve. Repeat same procedure for installing "O"-ring as above.

5. After the "O"-ring is installed, push and rotate spool until edge of spool is aligned with back surface of casting. Re-assembly end cap assembly.

HYDRAULIC SYSTEM (Continued)

HYDRAULIC SYSTEM SCHEMATICS

MODEL 5118H

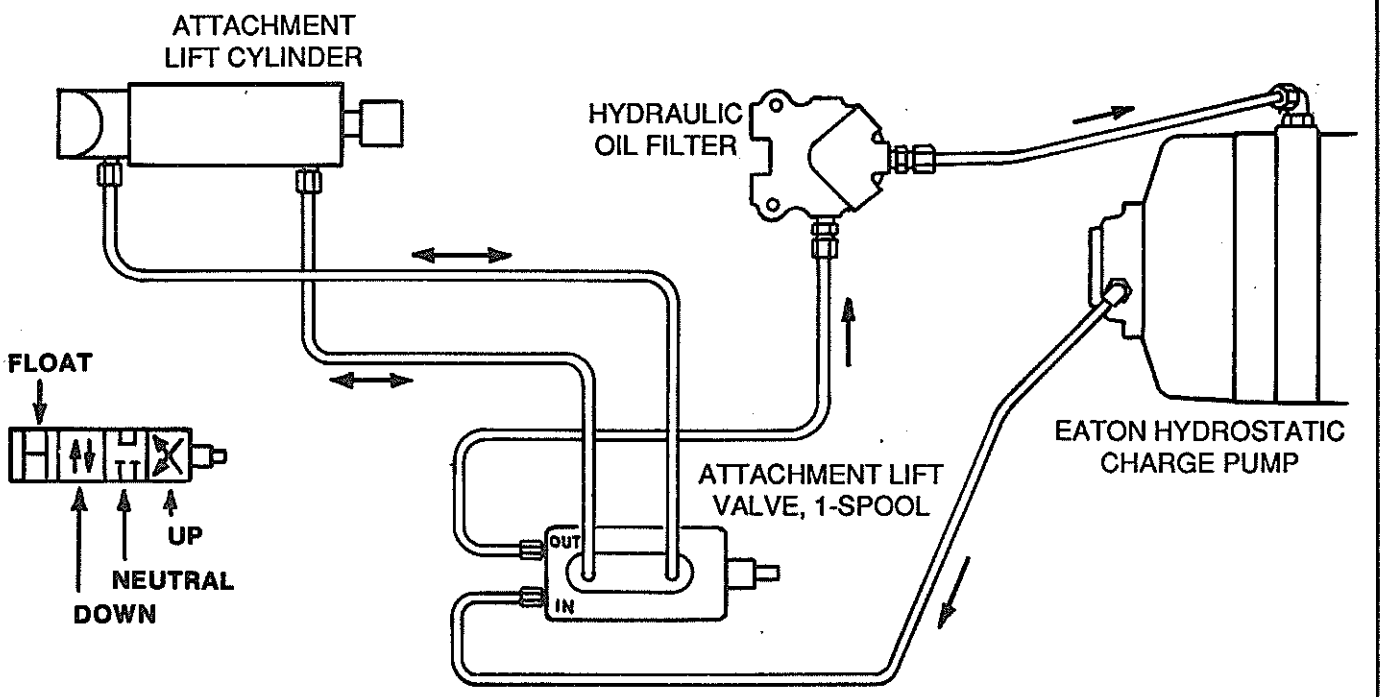


Fig. 6-10

MODEL 5117H & 5120H

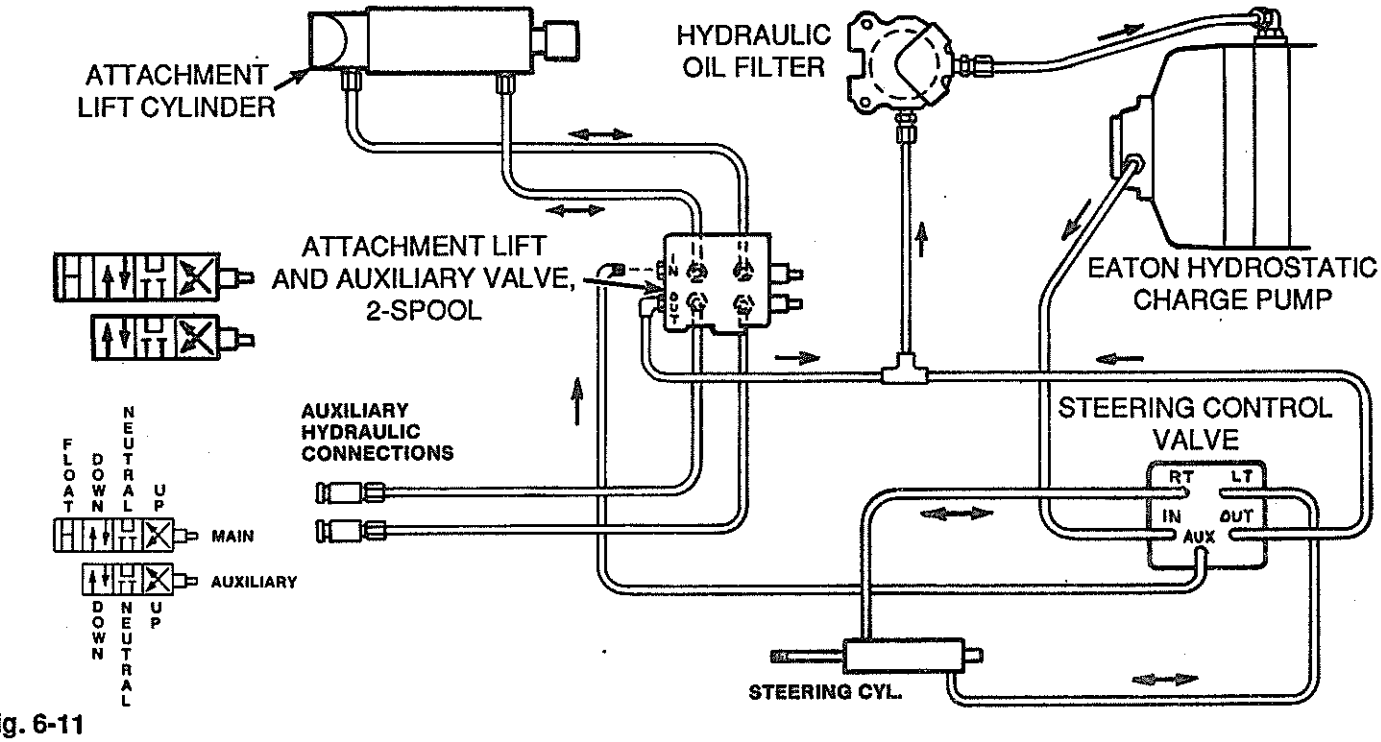


Fig. 6-11

TROUBLE SHOOTING GUIDE
GAS ENGINES

PROBLEM	PROBABLE CAUSE	REMEDY
Hard starting or loss of power.	1. Engine over-choked.	1. Close fuel petcock and engage starter until engine fires. Re-open fuel petcock.
	2. Carburetor dirty or improperly adjusted.	2. Re-adjust or clean carburetor.
	3. Faulty spark plugs or improper gap.	3. Adjust gap or replace plug.
	4. Clogged fuel line or filter.	4. Check fuel line or filter.
	5. Loose or grounded high tension wire.	5. check and repair wire lead.
	8. Faulty fuel pump.	8. Replace pump.
Overheating.	1. Insufficient available cool air.	1. Make sure area in front of flywheel is open.
	2. Dirty air intake screen shroud or cooling fins.	2. Clean intake screen, shroud and cooling fins.
	3. Improper fuel.	3. Clean and re-fill tank with proper fuel.
	4. Fuel mixture too lean.	4. Adjust carburetor.
	5. Engine overloaded.	5. Reduce load.
Backfiring.	1. Fuel mixture too lean.	1. Adjust carburetor.
	2. hot spot in muffler.	2. Replace muffler.
	3. Valve "sticking".	3. Free up valve.
Skip at high speed.	1. Spark plug gap too wide or wrong spark plug.	1. Adjust spark plug gap. or install correct plug.
	2. Improper carburetor setting or lack of fuel.	2. Refill tank and adjust carburetor.

TROUBLE SHOOTING GUIDE (Continued)

PROBLEM	PROBABLE CAUSE	REMEDY
Operating erratically.	1. Clogged fuel line.	1. Clean fuel line.
	2. Water in fuel.	2. Clean fuel system.
	3. Improper carburetor adjustment.	3. Adjust carburetor.
	4. Vent in gas cap plugged.	4. Clean gas cap vent.
	5. Faulty fuel pump.	5. Replace fuel pump.
	6. Faulty choke control.	6. Replace choke control.
	7. Loose ignition connections.	7. Clean and tighten ignition connections.
	8. Air leaks in manifold or carburetor connections.	8. Tighten manifold and carburetor.
Engine will not idle.	1. Improper carburetor idling adjustment.	1. Adjust idle speed.
	2. Carburetor clogged.	2. Clean carburetor.
	3. Spark plug gap set too close.	3. Adjust spark plug gap.
	4. Leaking carburetor or manifold gaskets.	4. Replace gaskets.

ENGINE REMOVAL--GASOLINE

CAUTION

BEFORE PERFORMING ANY ENGINE MAINTENANCE ON YOUR TRACTOR:

a. Disengage PTO drive.

b. Shift tractor into neutral.

c. Set tractor parking brake.

d. Stop tractor engine.

e. Remove key from ignition.

f. Disconnect spark plug wire from tractor engine spark plug and keep it from touching spark plug.

DISCONNECT NEGATIVE BATTERY CABLE FROM BATTERY AS WELL BEFORE ATTEMPTING THIS ENGINE REMOVAL.

ENGINE REMOVAL--GASOLINE (Continued)

1. Open hood. Remove screws holding side panels. Open side panels.

2. Disconnect main wiring harness from the headlight harness (A, Fig. 7-1) and cut cable ties (B) where attached to grille support.

3. Remove four (4) 3/8" capscrews (C) securing the front bumper to the frame, and the two (2) 1/4" screws (D, Fig. 7-2) at the rear of the grille support at the instrument panel support.

4. Remove the grille, side panels and hood as one assembly.

5. Disconnect engine electrical connection plug (E, Fig. 7-1), electric clutch connection (F) and cut related cable ties.

6. Disconnect small ground wire connection on intake manifold (G). Note routing of harness in engine compartment and location of harness ties prior to removal. Lay harness back on instrument panel.

7. Disconnect fuel line at filter (H, Fig. 7-2) and tightly plug open line and connection. Pull line out of heat shield (I).

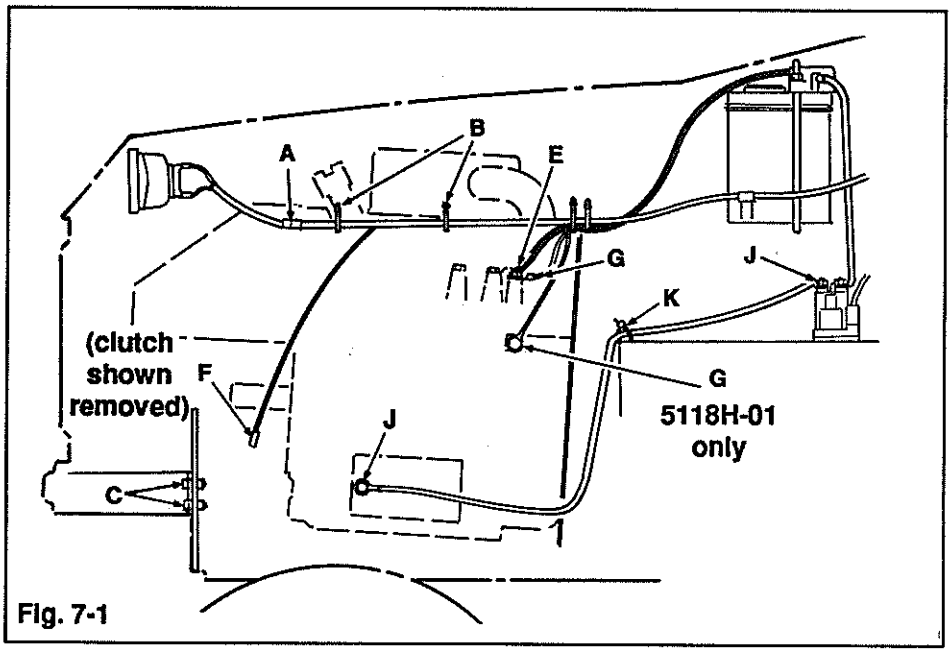


Fig. 7-1

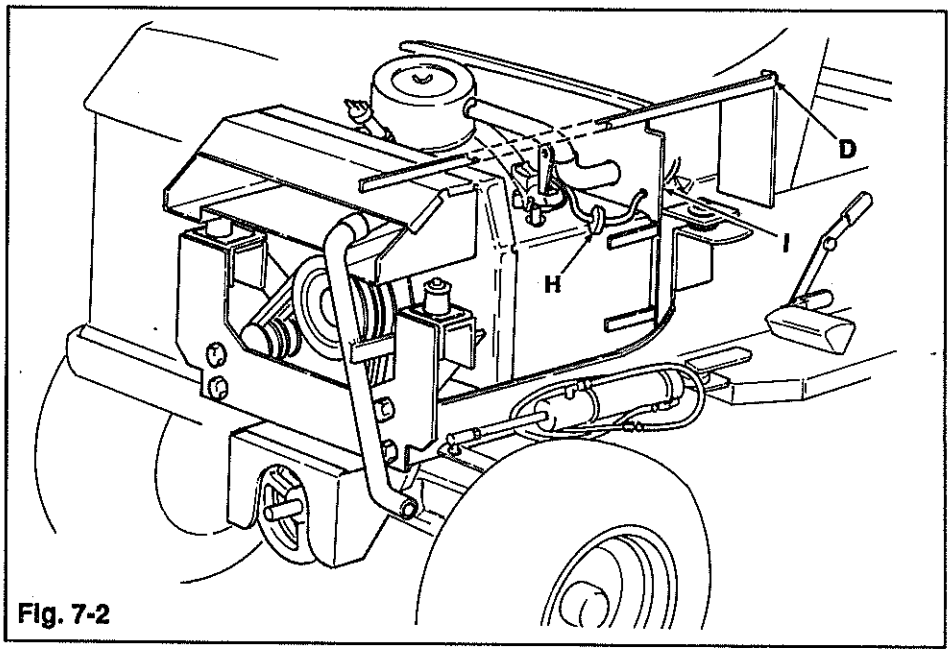


Fig. 7-2

CAUTION

HANDLE GASOLINE WITH CARE — IT IS HIGHLY FLAMMABLE. MAKE SURE FUEL LINE IS TIGHTLY PLUGGED BEFORE CONTINUING WITH THIS REPAIR.

NOTE:
If unit is equipped with a remote oil filter assembly, it will be necessary to unbolt filter from frame.

8. Disconnect solenoid to starter cable at solenoid and starter (J, Fig. 7-1) and cut cable tie (K) at tunnel near left rear engine mount.

9. Remove throttle and choke control cables from carburetor. Note original mounting location and routing for re-assembly. Pull cables out of heat shield.

ENGINE REMOVAL--GASOLINE (Continued)

10. Attach a lift chain to the lift brackets (N, Fig. 7-3) on the engine, and a leveling chain or strap under the front engine mounts (O). A hoist of minimum 300 lbs lift capacity should be used to lift the engine from the tractor chassis.

11. Loosen and remove the two rear engine mount bolts (P, Fig. 7-4), noting the location of the two (2) thick and one (1) thin flat washers in each mount prior to disassembly.

12. Apply sufficient tension to the hoist to slightly lift the rear mounts. Remove the four (4) 3/8" capscrews (Q) retaining the front engine mount plate to the front end of the frame rails.

13. Lower the engine until it rests on the frame rails. Shift the PTO idler pulley (R) to further relax tension on the PTO belts, and remove the belts from the clutch pulley. Move the belts clear of the clutch area by pulling them downward form the lower sheave (S).

14. Slowly begin lifting the engine from the chassis. It will be necessary to lift the front of the engine approximately 2" higher than the rear to clear the PTO idler as the engine is moved forward. Interference may be encountered between the blower heat shield and the tunnel near the rear mounts.

15. Move the engine forward, lifting slightly. The driveshaft will separate, allowing the engine to be lifted clear of the frame. The engine can then be removed completely from the unit.

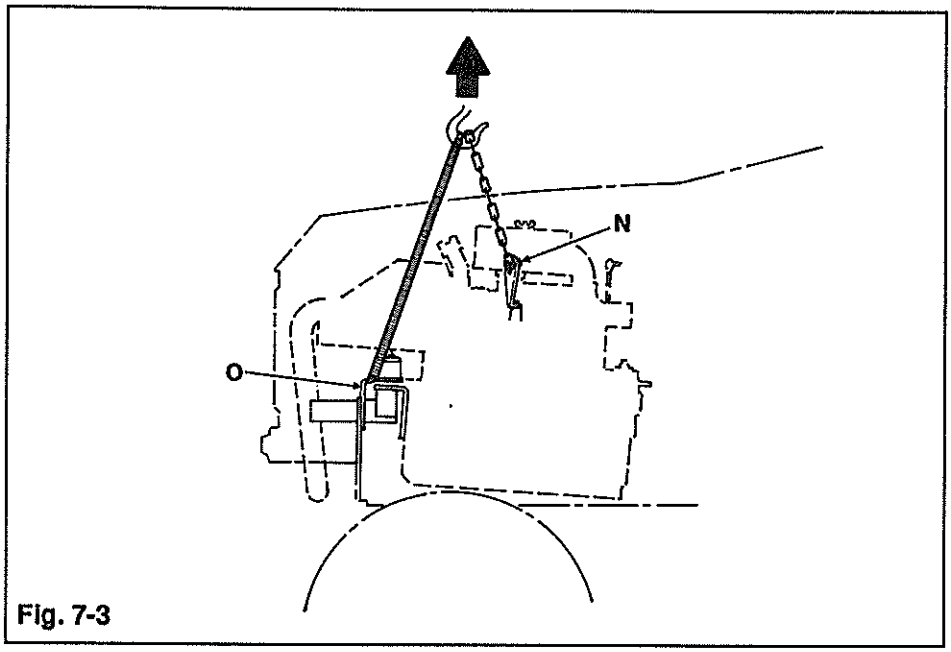


Fig. 7-3

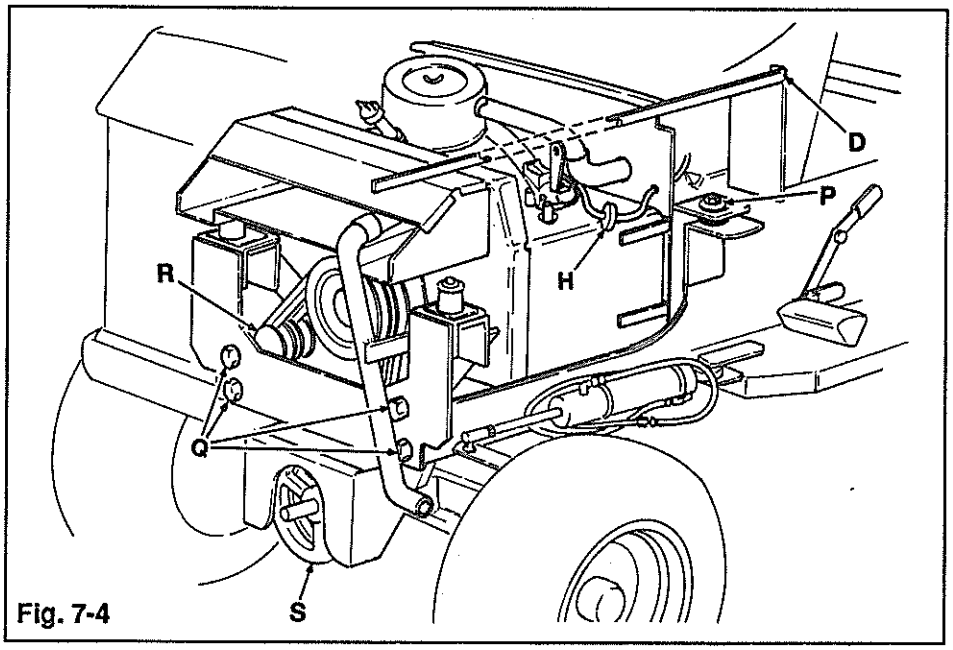


Fig. 7-4

ENGINE INSTALLATION--GASOLINE

1. Before installing engine, position all electrical harnesses, cables and fuel lines so they will not interfere with engine installation. Also check that these components are not positioned in a way which will not allow re-connection once the engine has been installed.

2. Move the engine into position slightly ahead and above the engine compartment. Because the driveshaft is moved into position under the tunnel, make sure the driveshaft is placed above the speed control shaft and the attachment lift shaft assembly.

3. When the engine is approximately 3" ahead of its mounts, the driveshaft sections should be joined from under the tractor. **NOTE: the driveshaft is balanced as an assembly and marked with indexing arrows during manufacture. Be certain to re-assemble the driveshaft with these arrows aligned to maintain driveline balance** (Inset, Fig. 7-6).

4. Continue moving the engine toward the mounts. As the rear mounts near contact, interference between the blower heat shield and tunnel may occur. Gentle rocking of the engine will allow the engine to move into position on the rear mounts.

5. Install, but do not tighten, the rear mount bolts (T, Fig 7-5).

6. Lower the engine completely down onto the frame. Move the PTO belt idler pulley (R) inward to relax belt tension, and install the PTO belts.

7. Remove the rear lift chain (U, Fig. 7-6), and lift slightly on the front of the engine until the holes align and the four 3/8" capscrews can be installed between the frame rails and the front engine mount plate.

8. Relax tension on the hoist. Tighten front engine mount plate bolts to locate engine. Rear mount bolts should then be tightened.

9. Attach and adjust throttle and choke control cables.

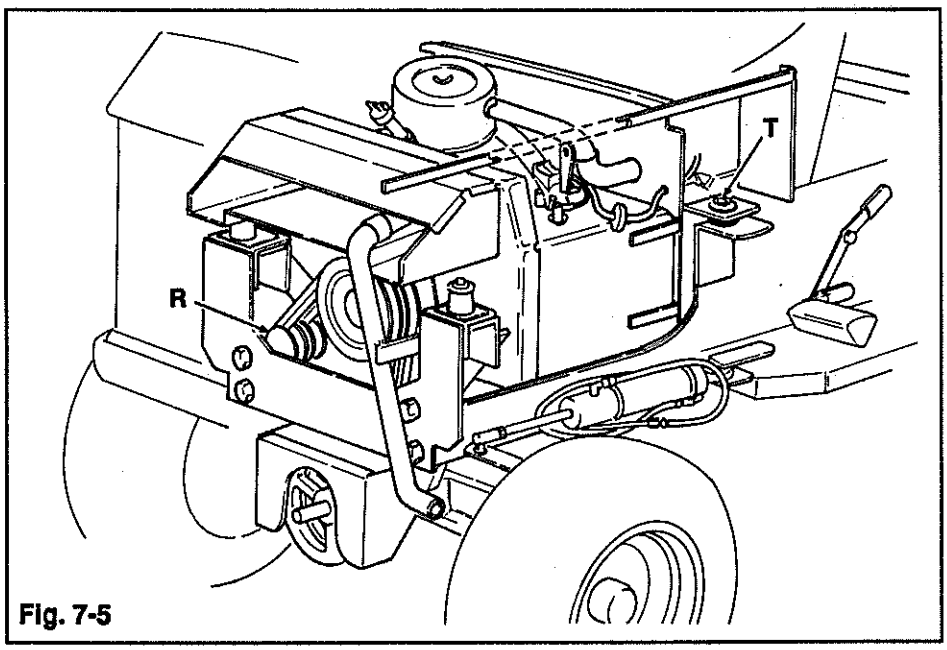


Fig. 7-5

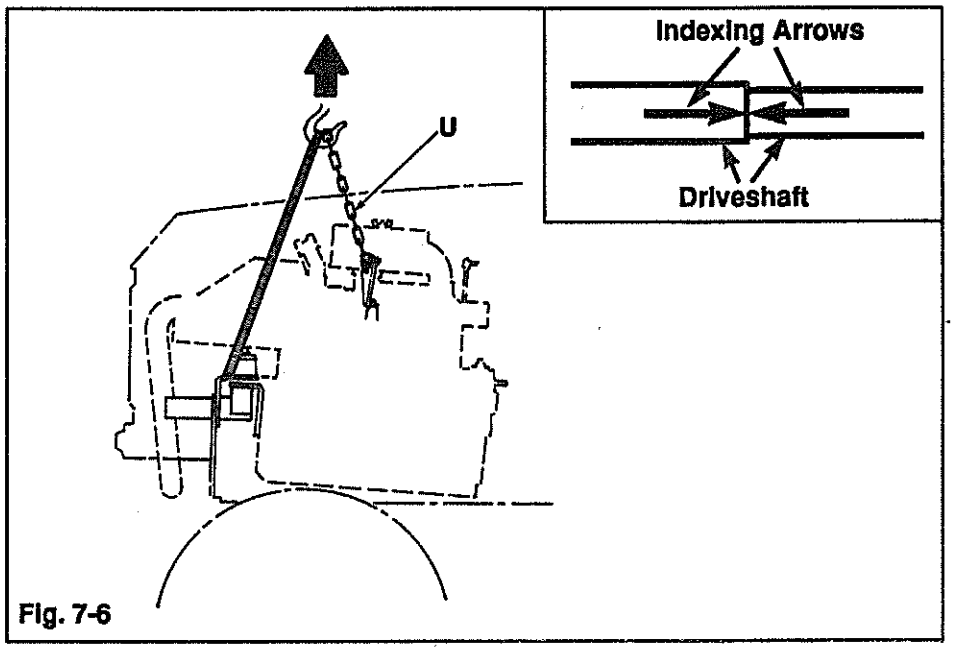


Fig. 7-6

ENGINE INSTALLATION--GASOLINE (Continued)

10 Position fuel line through heat shield (I Fig. 7-7) and connect to fuel filter (H).

11. Connect starter and solenoid to cable (J, Fig. 7-8). **NOTE: Install harness tie securing cable to left side of tunnel (K).**

12. Route main harness into engine compartment and connect clutch (F), engine plug (E) and ground connection (G) at intake manifold.

NOTE:
If unit is equipped with a remote oil filter assembly, re-install the oil filter base on the unit at this time.

13. Position hood, side panel and grille assembly over front of tractor. Place two 1/4" capscrews into grille supports at the instrument panel support (D, Fig. 7-7). Lift front of assembly and install four 3/8" capscrews into front engine mount and bumper (Q). Tighten all hardware.

14. Connect headlight harness to main harness (A, Fig. 7-8), and secure harness in engine compartment with cable ties (B) in the locations observed at disassembly.

15. Connect negative battery cable, open fuel valve at tank and start unit. Check for smooth operation of controls, abnormal sounds, vibrations or fluid leaks. Check electrical circuits for proper operation.

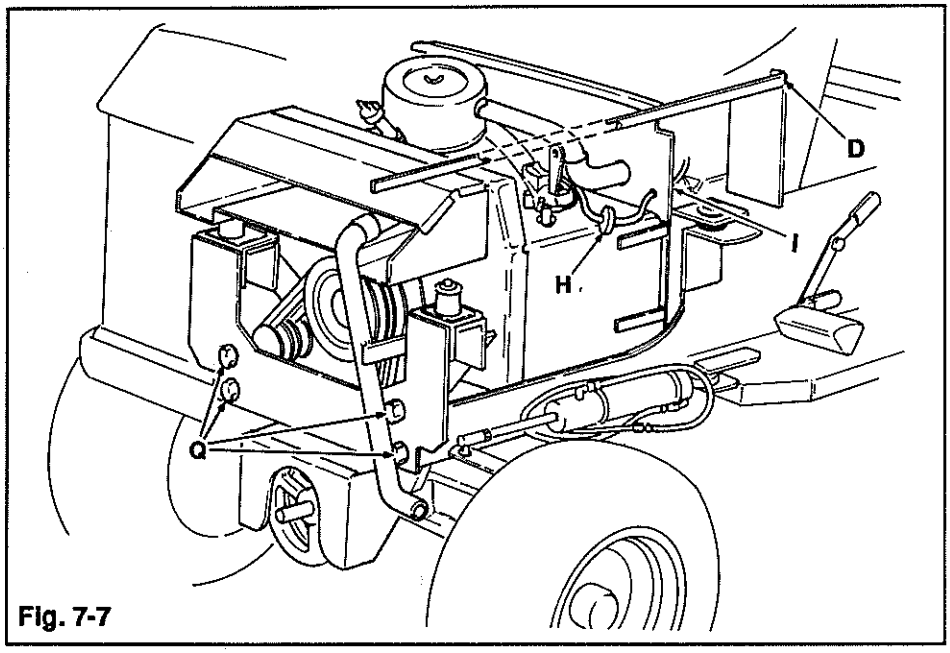


Fig. 7-7

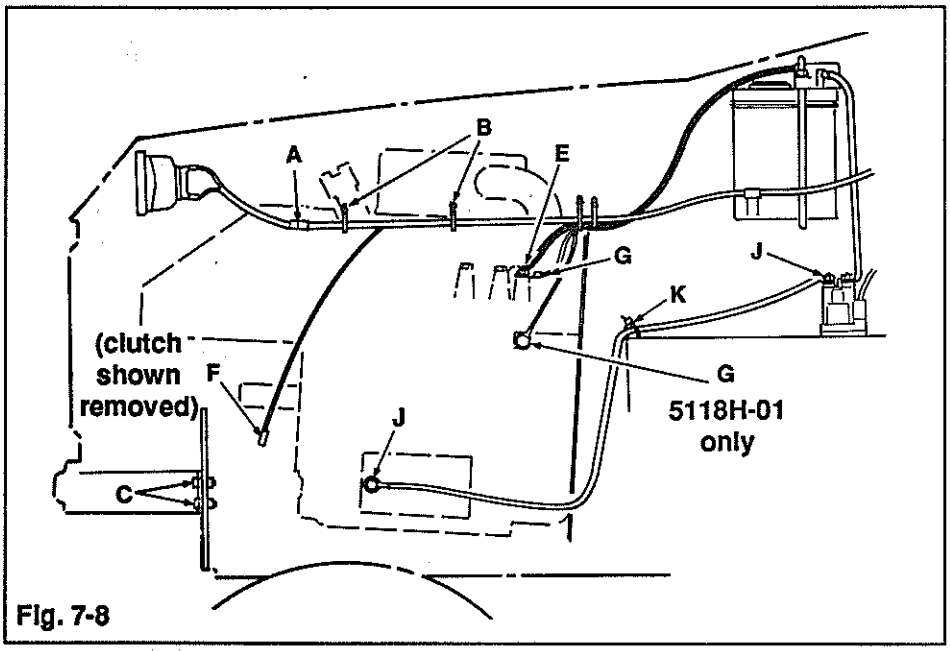


Fig. 7-8

STARTER REMOVAL AND INSTALLATION--GASOLINE

CAUTION

BEFORE PERFORMING ANY ENGINE MAINTENANCE ON YOUR TRACTOR:

a. Disengage PTO drive.

b. Shift tractor into neutral.

c. Set tractor parking brake.

d. Stop tractor engine.

e. Remove key from ignition.

f. Disconnect spark plug wire from tractor engine spark plug and keep it from touching spark plug.

DISCONNECT NEGATIVE BATTERY CABLE FROM BATTERY AS WELL BEFORE ATTEMPTING THIS ENGINE REMOVAL.

REMOVAL

1. Open hood and remove screws holding side panels.

2. Disconnect main wiring harness from the headlight harness (A, Fig. 7-9) and cut cable ties (B) where attached to grille support.

3. Remove four 3/8" capscrews securing the front bumper to the frame (C), and two 1/4" screws between the grille supports and the instrument panel support (D, Fig. 7-10).

4. Remove the hood, side panels and grille as an assembly.

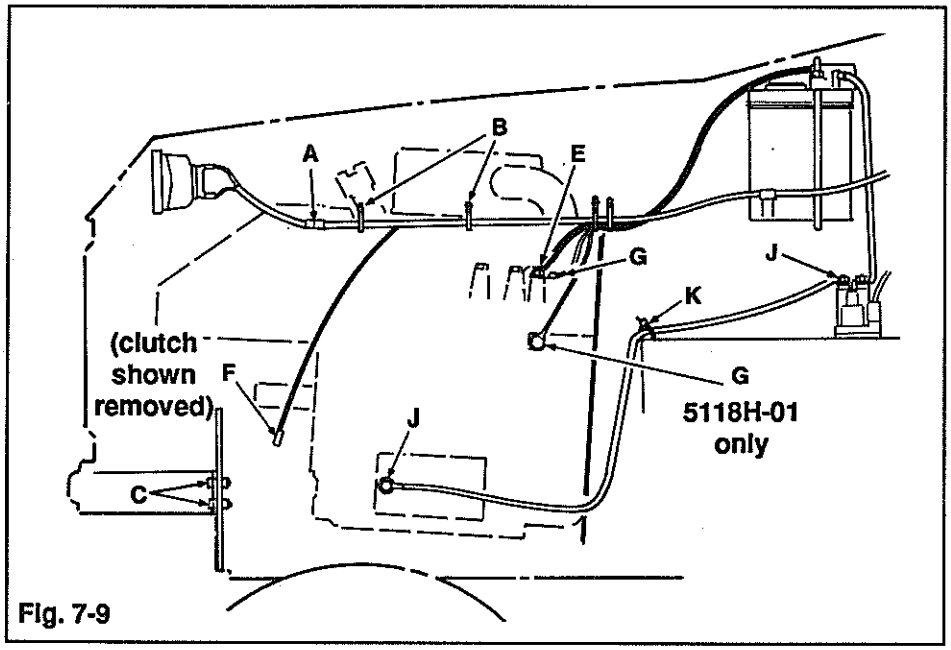


Fig. 7-9

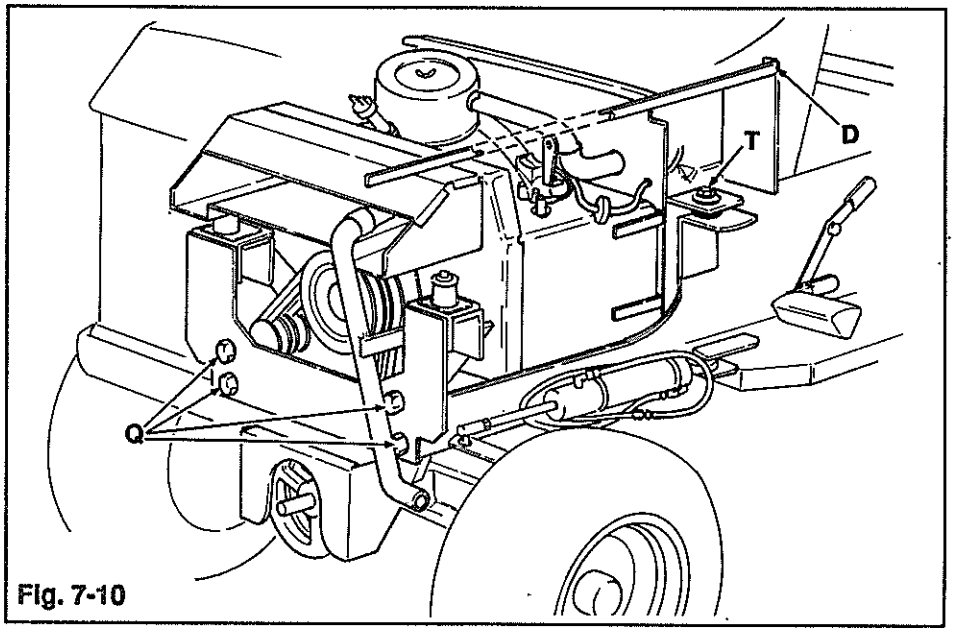


Fig. 7-10

5. Loosen the rear engine mount bolts (T, Fig. 7-10) until the end of the bolts are flush with the nuts.

6. Attach a lift strap under the front engine mounts and apply tension.

7. Remove the four (4) 3/8" capscrews (Q, Fig. 7-10) attaching the front engine mount plate to the front of the frame rails.

ENGINE (Continued)

STARTER REMOVAL AND INSTALLATION--GASOLINE (Continued)

8. Lower the engine completely down to the frame. Move the PTO idler (R, Fig. 7-12) inward to relax tension and remove the PTO belts (S).

9. Lift the front of the engine approximately 4" to allow clearance for starter removal.

10. Install a wood block (J, Fig. 7-11) between the engine cradle and frame for safety purposes.

11. Remove left-hand cylinder head cover and starter (K). (For additional engine servicing information, obtain the Kohler Engine Service Manual from your nearest Kohler engine dealer).

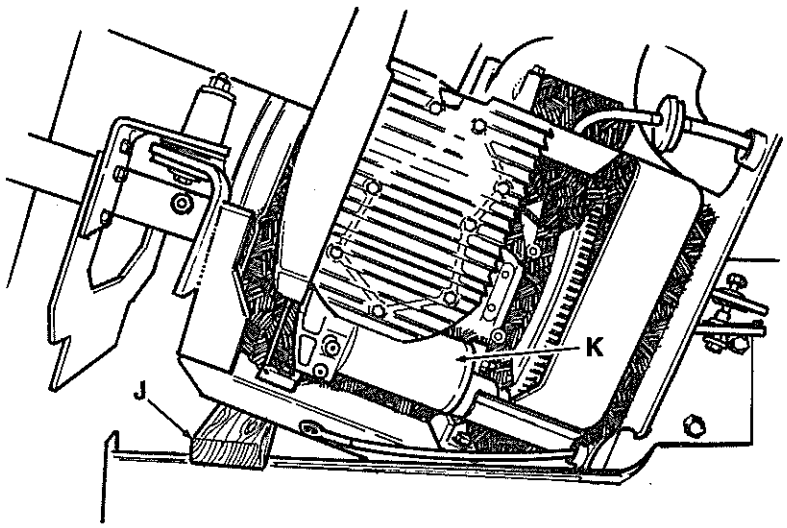


Fig. 7-11

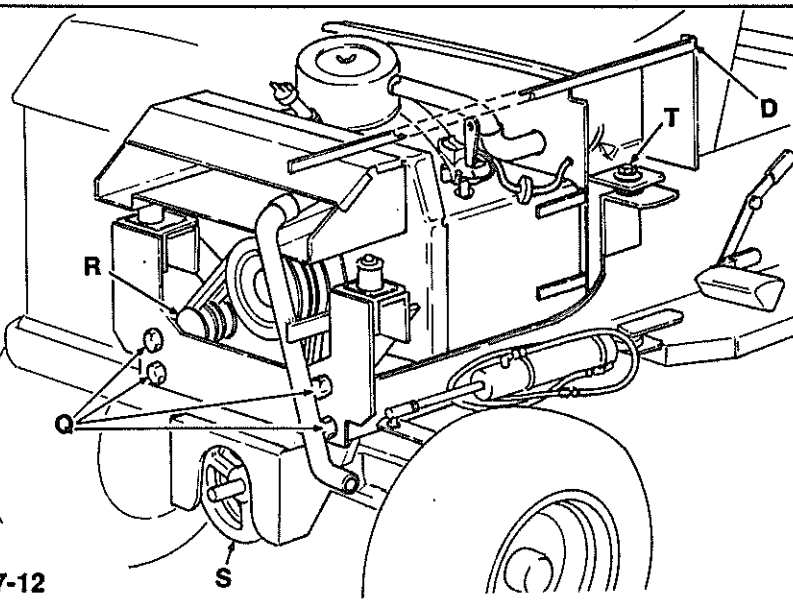


Fig. 7-12

INSTALLATION

1. Install starter (K, Fig. 7-11) and related covers to engine and connect wires.

2. Remove wood block (J) and lower engine completely down to the frame. Move the PTO idler (R, Fig. 7-12) inward and install belts (S)

3. Lift the engine until the bolts can be re-installed into the frame rails and the front engine mount plate.

4. Tighten engine mount plate capscrews (Q), then rear engine mount bolts (T) may be tightened. Remove lift strap.

5. Position hood, side panels and grille assembly over front of tractor. Place two 1/4" capscrews into the grille supports at the steering support (D). Lift front of assembly and install four (4) 3/8" capscrews into front engine mount and bumper. Tighten all hardware.

6. Connect headlight harness to main harness, and secure harness in engine compartment with cable ties in the locations observed at disassembly.

7. Connect negative battery cable and start unit. Check operation of all controls.

ENGINE REMOVAL--DIESEL

CAUTION

BEFORE PERFORMING ANY ENGINE MAINTENANCE ON YOUR TRACTOR:

a. Disengage PTO drive.

b. Shift tractor into neutral.

c. Set tractor parking brake.

d. Stop tractor engine.

e. Remove key from ignition.

f. Disconnect spark plug wire from tractor engine spark plug and keep it from touching spark plug.

DISCONNECT NEGATIVE BATTERY CABLE FROM BATTERY AS WELL BEFORE ATTEMPTING THIS ENGINE REMOVAL.

1. Disconnect main wiring harness from headlight harness (A,Fig. 7-13), electric clutch (B), alternator (C), starter (D) and engine connections: oil pressure sender (E), water temperature sender (F) and glow plugs (G). Use care to mark wiring at alternator and starter to avoid confusion when re-connecting. **(Note routing of harness around engine compartment and location of cable ties prior to removal. This will aid in installation later on.)**

2. Use a 12mm wrench to remove battery cable at starter terminal and ground cable at lifting bracket (H, Fig. 7-14). Re-install lifting bracket and tighten bolt. Remove the battery ground cable from the engine block at the right rear engine mount (I) (17mm wrench required).

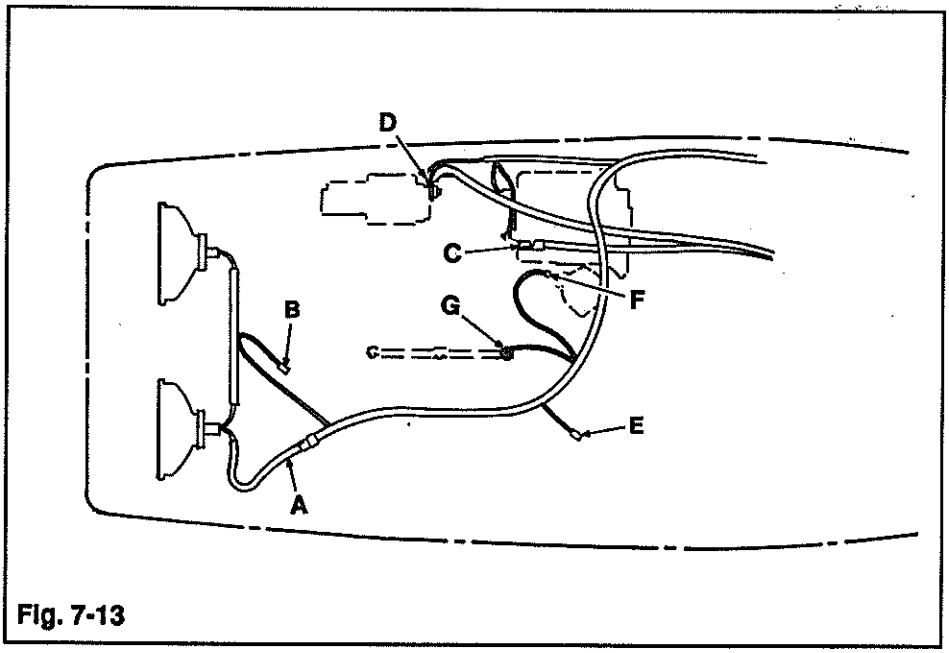


Fig. 7-13

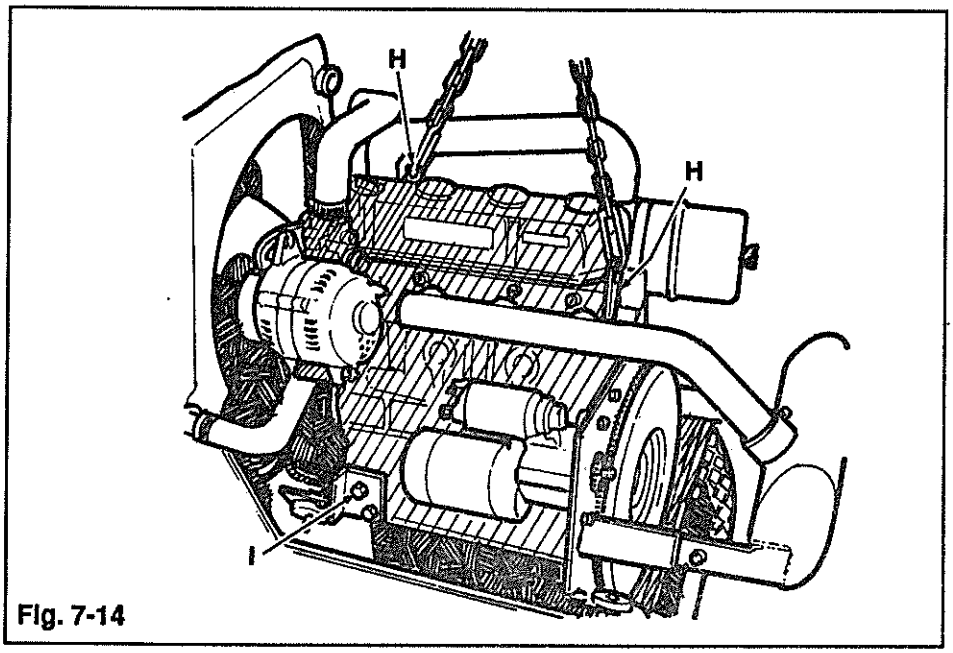


Fig. 7-14

ENGINE REMOVAL--DIESEL (Continued)

2. Remove four (4) screws securing heat shield to underside of front bumper.

3. Remove four (4) 3/8" capscrews securing the front bumper to the front engine mounts, and two (2) 1/4" screws at rear of grille braces (next to radiator).

4. Remove grille, side panels and hood as an assembly.

5. Drain coolant from engine and radiator. Loosen the lower radiator hose at the radiator outlet and allow coolant to drain into a container. Disconnect upper radiator hose at radiator end.

6. Disconnect throttle and shut-off control cables (J, Fig. 7-15) from the governor control levers at the engine, and remove cables from mounting bracket.

7. Remove fuel line from tank to filter (K) and leak-off line (L) at the # 3 (forward) injection nozzle. Tightly plug or cap lines to prevent entry of dirt while disconnected.

8. Remove driveshaft hub from the engine crankshaft pulley. Hold the driveshaft with a 3/4" open-end wrench on he rectangular section of the shaft while removing the three (3) metric capscrews in the hub. A 17mm wrench or socket is required for removal.

9. Loosen muffler clamp bolt (M) and remove muffler mounting bolts (N). Remove muffler from exhaust pipe.

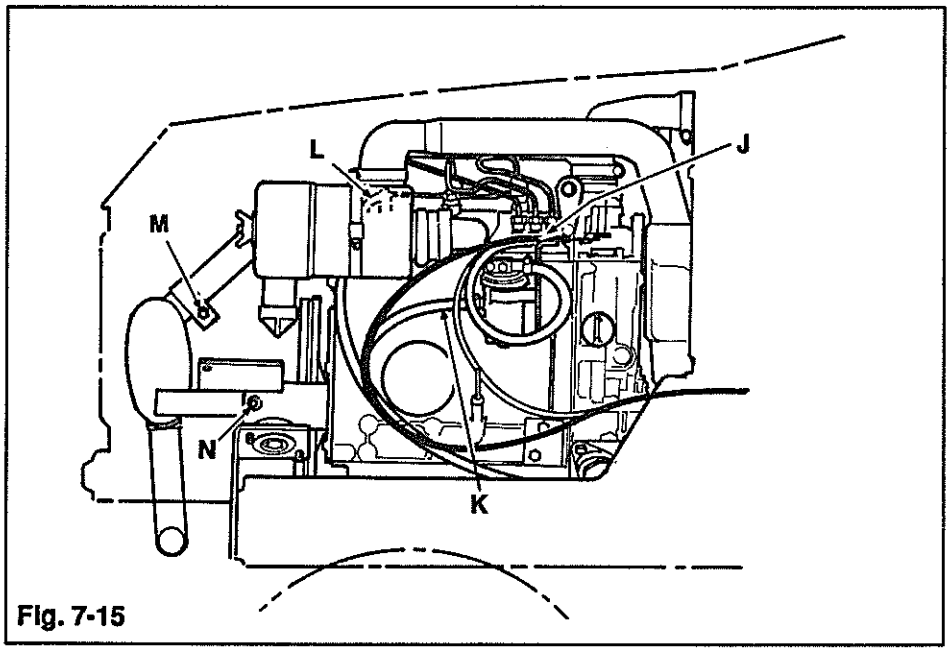


Fig. 7-15

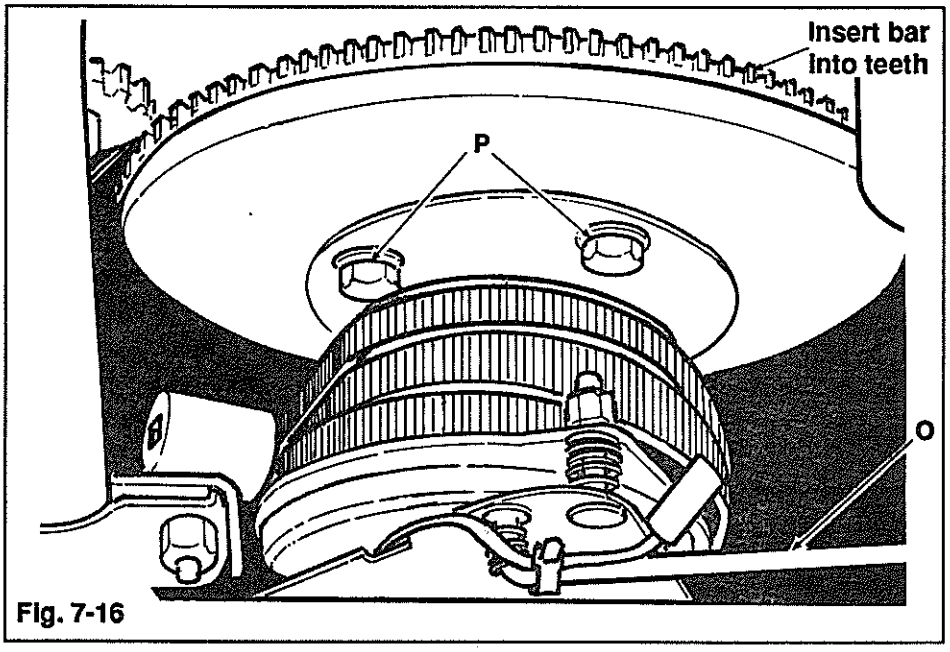


Fig. 7-16

10. Remove the clutch anchor rod (O, Fig. 7-16) and the four metric capscrews retaining the electric clutch to the flywheel (P) Hold the flywheel with a bar while

ENGINE REMOVAL--DIESEL (Continued)

loosening the capscrews with a 17mm open-end wrench. (the screws will remain in the drive flange). Remove clutch assembly.

11. Connect a lift chain to the engine lift brackets (Q, Fig. 7-17). A hoist of 300 lbs. minimum capacity should be used to lift the engine from the tractor chassis.

12. Loosen the four (4) 3/8" engine mount bolts (R), and remove them from the mounts. **NOTE: the right rear mount bolt cannot be completely removed due to interference with the engine.**

13. Carefully lift the engine from the chassis. As the fan is removed from the shroud area, be careful not to damage the radiator fins.

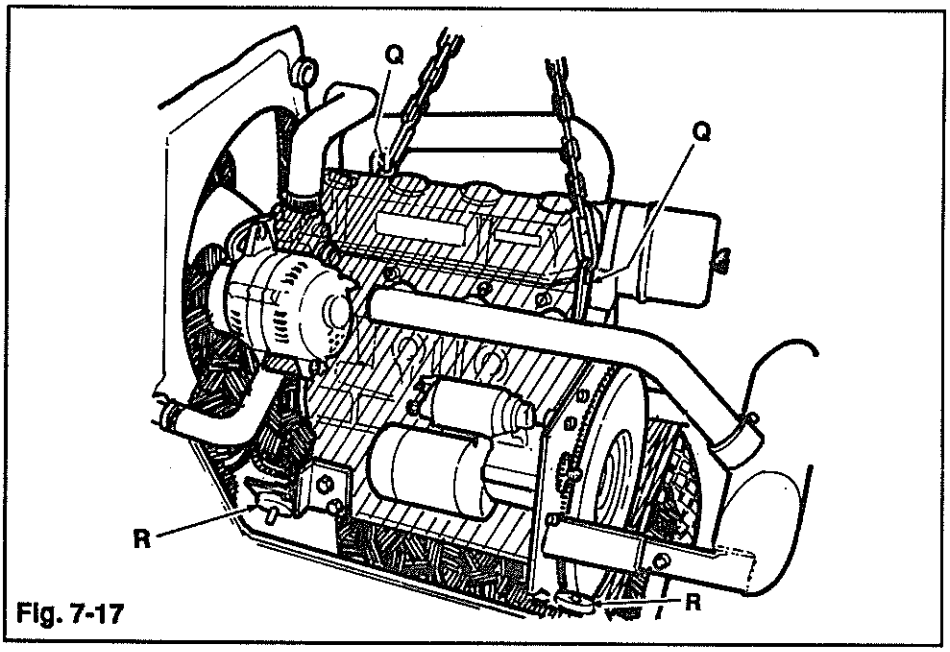


Fig. 7-17

ENGINE INSTALLATION--DIESEL

1. Prior to the actual engine installation, all electrical harnesses and cables, controls and fuel lines should be positioned in the frame in their normal routing locations, and loose ends moved away from the engine compartment to eliminate the possibility of damage and interference as the engine is lowered into the chassis.

2. Pull the PTO belts down out of the lower PTO pulley to eliminate interference with the engine during installation.

3. Move the engine into position above and ahead of its mounted position (Fig. 7-18), the rear (fan) end slightly lower than the flywheel end.

4. Slowly move the engine down and in toward the mounts. Check for interference with controls, wiring, etc. Continue to lower engine into chassis until the motor mounts contact the frame.

5. Install the engine mount bolts (S, Fig. 7-18). Use care to install the large flat washer against the rubber portion of the mount, and the flange lock nut against the steel mounting surface. Tighten all mount bolts at this time.

6. Install the electric clutch assembly. To ease installation, the PTO belt idler should be securely blocked to relieve tension from the belts as the clutch is moved into position on the flywheel. Tighten the clutch mounting screws (P, Fig. 7-19) and install the clutch anchor rod (O). Remove the block from the belt idler pulley.

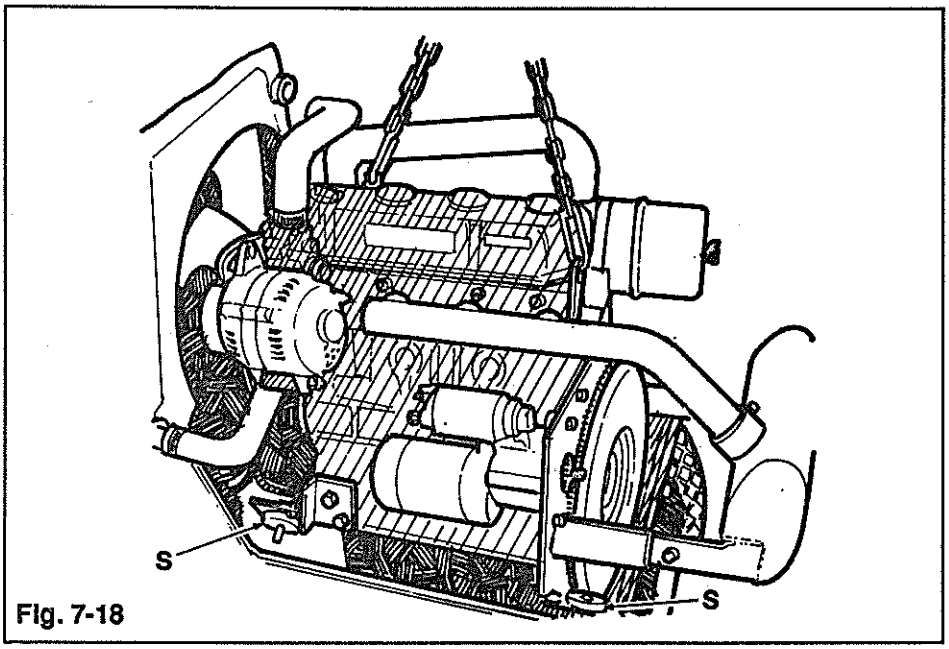


Fig. 7-18

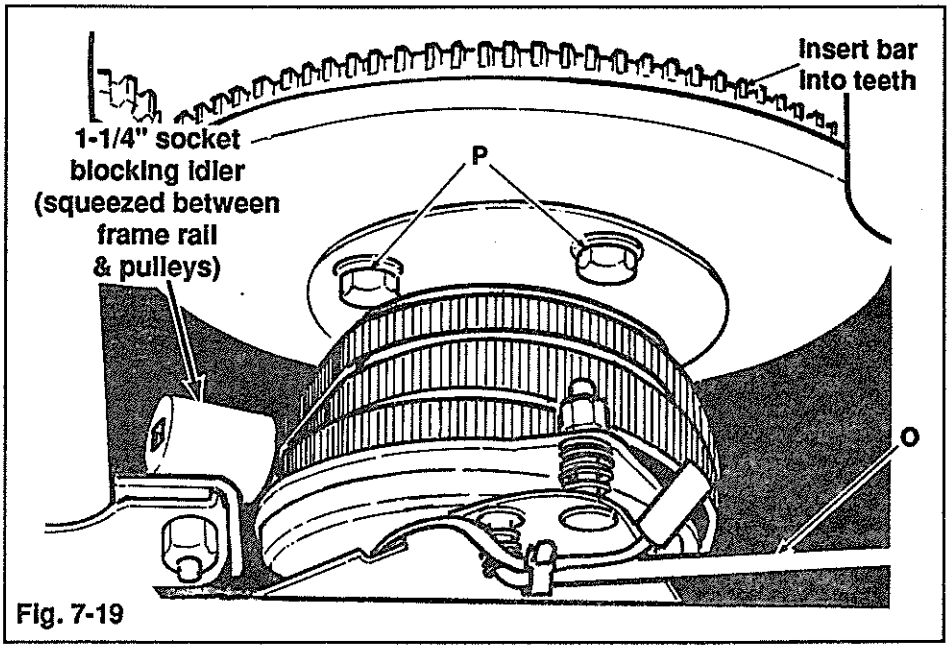


Fig. 7-19

7. Re-install muffler and mounting hardware.

8. Install the driveshaft to the engine pulley.

9. Re-attach the fuel supply and leak-off lines.

ENGINE INSTALLATION--DIESEL (Continued)

10. Connect the throttle and shut-off cables (J, Fig. 7-20). Check for proper routing around engine mount, and adjust for full travel of each control.

11. Connect upper and lower radiator hoses and tighten clamps. Fill cooling system with coolant and check for leaks. If additional coolant required, use a 50-50 water/anti-freeze mix.

12. Install heat shield over muffler outlet elbow.

13. Install hood, grille and side panel assembly. Place the assembly over the front of the tractor and install the two (2) 1/4" capscrews to the rear at the grill braces. Lift the grille into place and install the four (4) 3/8" capscrews into the grille and front engine mounts. Tighten all hardware.

14. Install the heat shield to the lower side of the bumper.

15. Connect all remaining wiring and secure with appropriate cable ties.

16. Connect negative battery cable and open fuel valve at tank. Bleed the supply line, filter and injection pump according to procedure outlined in Section 4, page 4-5 of this manual.

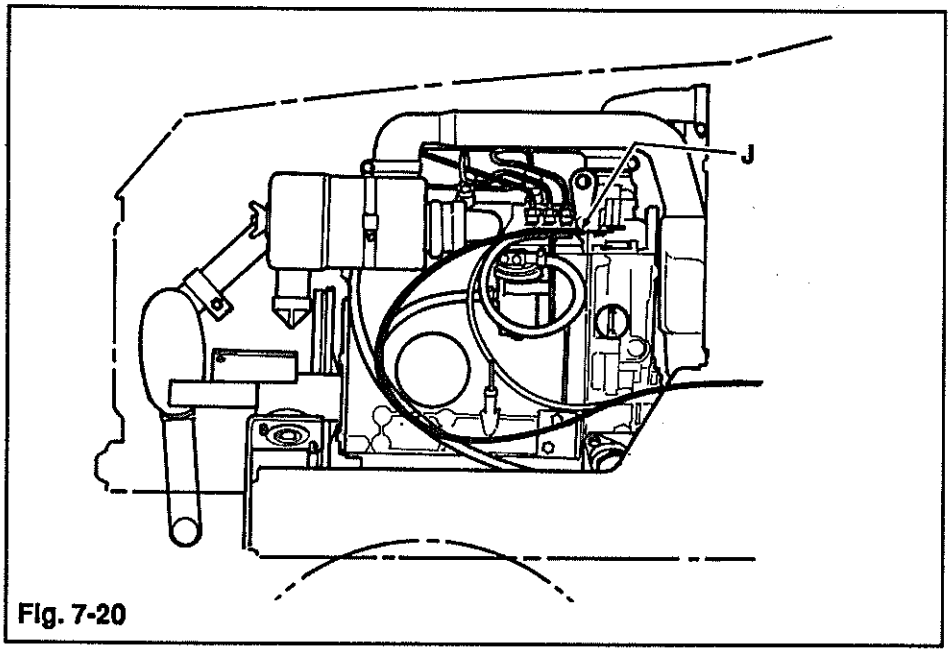


Fig. 7-20

17. Start the engine. Check operation of allow electrical circuits and control functions. After 10-15 minutes of operation, thoroughly check for fluid leaks and any abnormal sounds or vibrations through all engine speed ranges.

ENGINE (Continued)

PTO CLUTCH REMOVAL/INSTALLATION AND BELT REPLACEMENT

CAUTION

BEFORE PERFORMING ANY ENGINE MAINTENANCE ON YOUR TRACTOR:

a. Disengage PTO drive.

b. Shift tractor into neutral.

c. Set tractor parking brake.

d. Stop tractor engine.

e. Remove key from ignition.

f. Disconnect spark plug wire from tractor engine spark plug and keep it from touching spark plug.

DISCONNECT NEGATIVE BATTERY CABLE FROM BATTERY AS WELL BEFORE ATTEMPTING THIS ENGINE REMOVAL.

PTO CLUTCH REMOVAL AND BELT REPLACEMENT (5118H, 5118HS & 5120H)

NOTE: DO NOT USE WHEEL PULLER TO REMOVE CLUTCH/BRAKE.

(Refer to figures on page 7-3 for steps 1 thru 4).

1. Remove hood and side panels.
2. Disconnect main wiring harness from the headlight harness (A, Fig. 7-1) and cut cable ties (B) where attached to grille support.
3. Remove four (4) 3/8" capscrews (C) securing the front bumper to the frame, and the two (2) 1/4" screws (D, Fig. 7-2) at the rear of the grille support at the instrument panel support.
4. Remove the grille, side panels and hood as one assembly.
5. Remove the 8 screws and 4 brackets holding hood support rods to underside of hood. Remove hood and disconnect polarized plug from clutch.
6. Push in idlers (R, Fig. 7-23) and remove belts from clutch.
7. Remove Bolt, lockwasher and lockwashers (B, Fig.7-21).
8. Remove 4 locknuts (E) and remove pulley/brake plate assembly from crankshaft.
9. Remove 4 springs from studs (A).
10. Remove rotor (G) and key (H).
11. Remove 4 studs (A). Remove field coil (F).

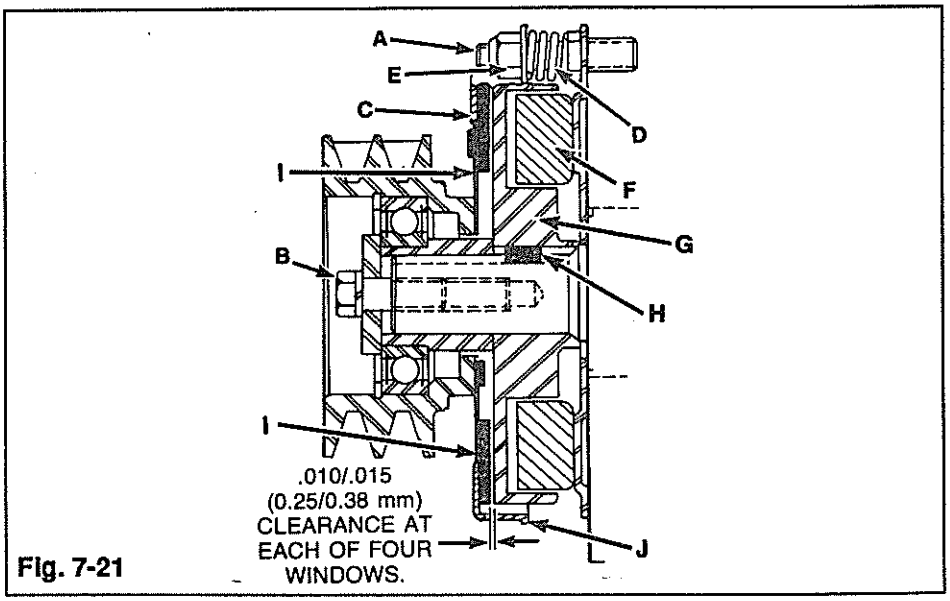


Fig. 7-21

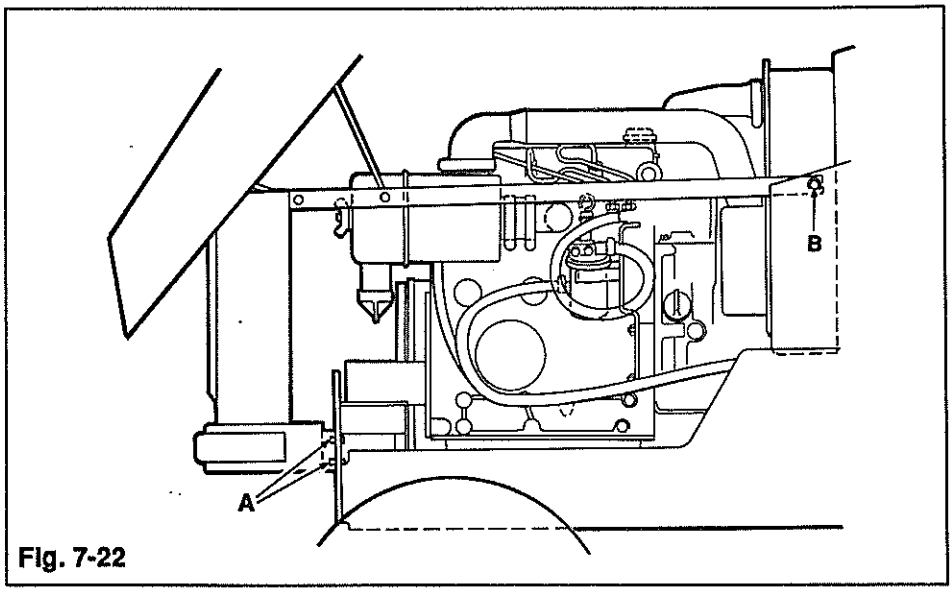


Fig. 7-22

PTO CLUTCH REMOVAL/INSTALLATION AND BELT REPLACEMENT (Continued)

PTO CLUTCH REMOVAL AND BELT REPLACEMENT (5117H)

1. Open hood and side panels.
2. Cut cable tie securing clutch harness to upper heat shield. Unplug headlight harness.
3. Remove four (4) screws securing heat shield to underside of bumper.
4. Remove four (4) 3/8" capscrews securing front bumper to front engine mount (A, Fig. 7-22) and two 1/4" screws at rear of grille braces (next to radiator) (B).
5. Remove hood, side panels and grille as an assembly.
6. Loosen muffler clamp and muffler mounting bolts, slide muffler off exhaust pipe.
7. Remove clutch anchor rod (C, Fig. 7-24) and unplug clutch lead. Remove the four (4) metric capscrews (D) retaining the electric clutch to the flywheel. Hold the flywheel with a bar while loosening the capscrews with a 17mm open-end wrench.
8. Remove the clutch assembly.

NOTE:

THIS CLUTCH IS NOT SERVICEABLE AND MUST BE REPLACED AS AN ASSEMBLY.

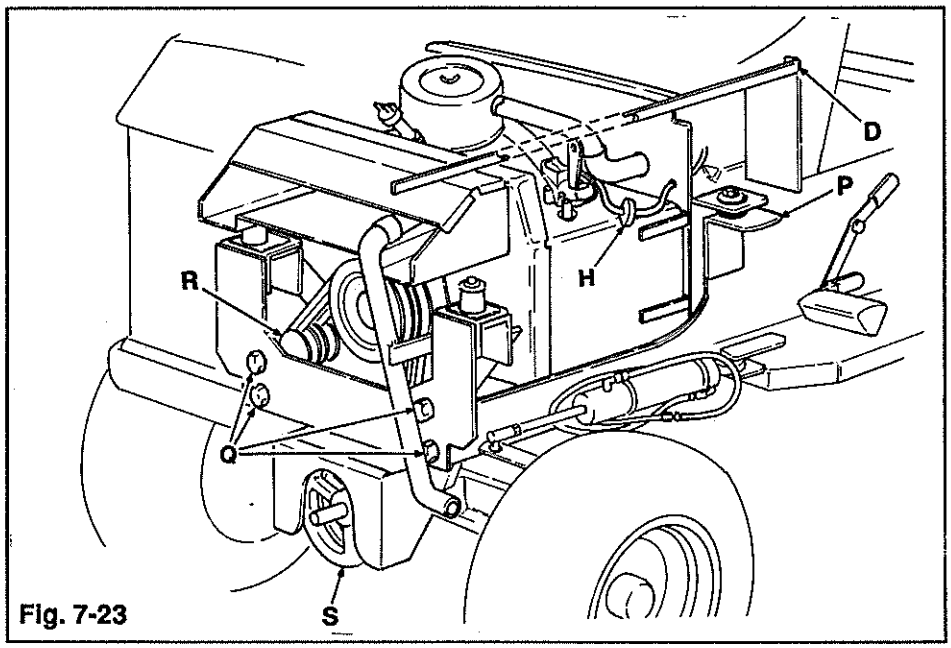


Fig. 7-23

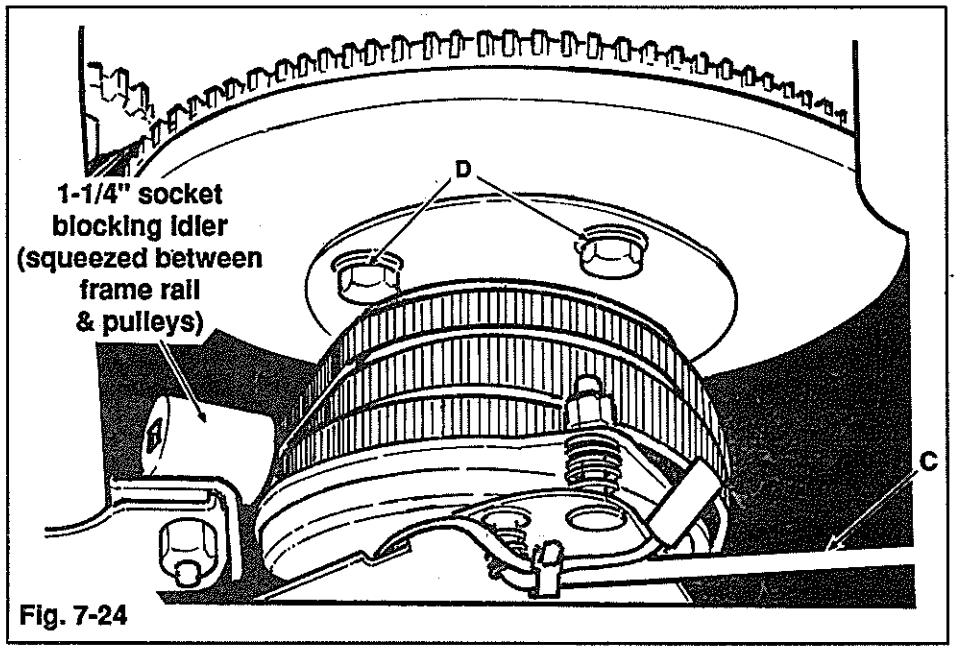


Fig. 7-24

CLUTCH INSTALLATION (5118H, 5118HS & 5120H)

1. Position coil assembly (F, Fig. 7-21) on engine piloting it in crankshaft seal bore. Secure with four mounting studs (A).
3. Remove rust, burrs and dirt form engine shaft with sandpaper.
4. Apply light coat of grease or oil to shaft.
5. Insert key (H) into keyway on crankshaft.
6. Install rotor (G) onto engine shaft, over key (H), until it bottoms out

PTO CLUTCH REMOVAL/INSTALLATION AND BELT REPLACEMENT

on crankshaft shoulder.

7. Install springs (D) over studs (A).
8. Install pulley/brake plate assembly over crankshaft and studs (A).
9. Install washer, lockwasher and bolt (B) into crankshaft and tighten between 30-35 ft/lbs (40-47 N/m).
10. Install 4 locknuts (E) onto studs (A).
11. Tighten 4 nuts evenly until a clearance of .010" to .015 (.2-.4 mm) is obtained between rotor (G) and drive plate (I). Check this measurement at each of the 4 window slots located on brake plate.
12. push in idlers (R, Fig. 7-23) and re-attach belts. Re-attach hood, grille and side panels. Close hood and side panels. Re-connect polarized plug to clutch.

CLUTCH INSTALLATION (5117H)

1. Securely block PTO belt idler (See Fig. 7-23) to relieve tension for clutch installation.
2. Install clutch to flywheel. Hold flywheel to assure adequate torque on mounting screws.
3. Remove block from idler pulley.
4. Install clutch anchor rod and clutch lead.
5. Check clutch clearance adjustment. Connect negative battery cable and check clutch operation.
6. Install and tighten muffler and associated hardware.
7. Install heat shield over muffler outlet elbow.
8. Install hood, side panel and grille as one assembly. Place assembly over the front of the tractor and install the two 1/4" capscrews to the rear of the grille support. Lift the grille into place and install the four (4) 3/8" capscrews into the grille and front engine mounts. Tighten all hardware.
9. Install heat shield to lower side of bumper and tighten screws.
10. Connect all remaining wiring and secure with appropriate cable ties.

PTO CLUTCH TROUBLESHOOTING

1. **ELECTRICAL DATA—**
   a. See wiring diagram in Section 2 of this manual.

2. **CLUTCH DOES NOT ENGAGE—**
   a. Check electrical system for broken wires or bad connections.

   b. Check voltage at clutch lead. Voltmeter should read more than 10 volts. If voltmeter does not register a reading, look for broken wires or connect clutch lead and check resistance reading of clutch coil. A normal resistance reading should be between 3.0 and 2.3 ohms. A reading outside these values indicates a faulty coil. The field assembly should then be replaced. Check armature/ rotor gap. this is done by inserting a feeler gauge in the four (4) slots provided in the brake flange. The gap should be between .010 "-.020" (0.25mm-0.51mm) with the clutch/brake switch in the "off" position. If the gap is greater, re-adjust brake as described in "Maintenance" (below).

3. **ENGINE DRIVEN ATTACHMENT ROTATES SLOWER THAN NORMAL—**

a. Check for loose belts.

   b. Inspect engine driven attachment with clutch belt removed. Attachment should turn freely.

   c. Check clutch/brake pulley grooves for grease or oil.

   d. Check clutch/brake working surfaces for grease or oil.

NOTE: REMOVE GREASE OR OIL FROM CLUTCH/BRAKE WORKING SURFACES AS OUTLINED BELOW IN "MAINTENANCE".

ELECTRIC PTO CLUTCH SPECIFICATIONS:

Voltage .....12 VDC
Resistance.....3.2 Ohms
Current Draw .....3.8 Amps

PTO CLUTCH MAINTENANCE

If the clutch/brake has not been used over a long period of time, the following procedure is recommended prior to its use:

a. Position transmission in neutral position.

b. Start tractor engine and put throttle in 'FAST' position.

c. Turn clutch/brake switch on and off six times, engaging and disengaging driven attachments.

NOTE: ALLOW ENGINE DRIVEN ATTACHMENTS TO COME TO A COMPLETE STOP BETWEEN ON-OFF CYCLES.

The clutch/brake is now ready for continuous, trouble-free duty.

MOWER DECKS

MOWER LEVELING

For best cutting results, it is important that the mower be leveled correctly.

1. Check tractor tire pressure:

   Front: 12 to 14 PSI (14 PSI with front mounted attachments).
   Rear: 10 to 12 PSI

2. Place mower on a level, flat surface.

3. Lower mower to the ground.

(42" & 48" MOWERS, Models 51042S, 51048S & 51048R)

4. Measure mower blade tip height front and rear. Front of blade should be even with rear (A, Fig. 8-1). If not, adjust rod length of front links (C). Lengthen rods to lower front and shorten rods to raise front.

5. Raise and lower the mower attachment using the lift system a couple of times. Re-check leveling.

(60" MOWER, Model 51060S)

NOTE: 60" mowers equipped with 4 gauge wheels do not have leveling adjustments. When all four gauge wheels are on a level surface, and the pins are in the same position, the mower will be level.

4. Measure mower blade tip height front and rear. Front of blade should be even with rear. If not, adjust rod length of front links (D, Fig. 8-2). Lengthen rods to lower front and shorten rods to raise front.

5. Raise and lower the mower attachment using the lift system a couple of times. Re-check leveling.

NOTE: 60" mowers do not have a side-to-side leveling adjustment.

SIDE-TO-SIDE LEVELING (42" & 48" MOWERS

If side to side leveling is required, an adjustment is provided at the rear left gage wheel. Adjust by loosening screws (A, Fig. 8-3) and either lowering or raising "L" rod (B).

42" & 48" MOWERS

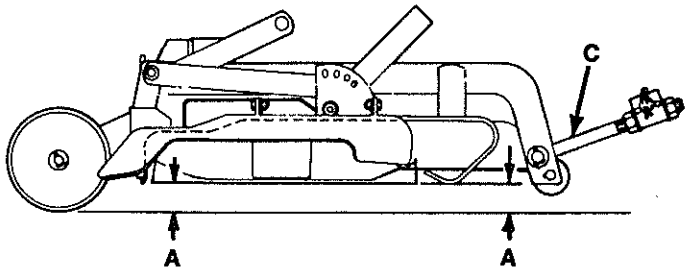


Fig. 8-1

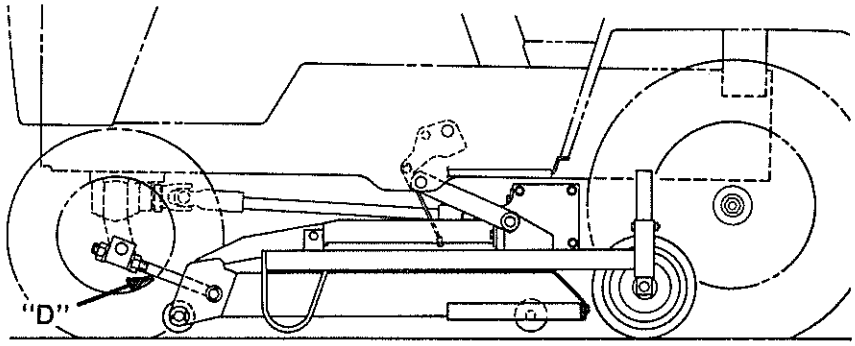


Fig. 8-2

LUBRICATION

There are three grease fittings on the mower; one on top of each blade spindle. Lubricate the grease fittings after every 100 hours or annually with multi-purpose grease.

Frequently lubricate the linkage, rollers and other pivot points with a few drops of lubricating oil, especially after washing the mower.

(42" & 48" MOWERS)

The gear case is filled at the factory with 11oz. of EP 90 gear lube. Remove plug at rear of gear case, check oil level. Oil should be to the level of the plug opening. check oil every 25 hours of operation.

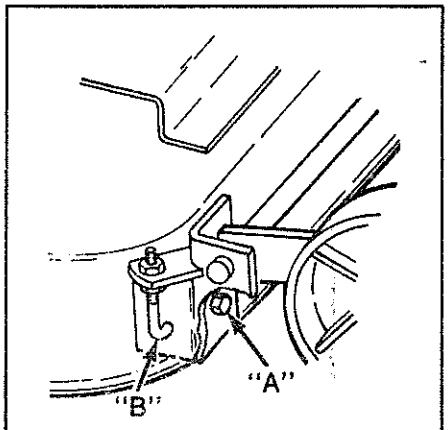


Fig. 8-3

ATTACHMENTS (Continued)

MOWER DECKS (Continued)

(60" MOWER)

The gear case is filled at the factory with 16oz. of EP 90 gear lube. Remove plug (Ref.19, Fig. 8-8) at rear of gear case to fill. Check oil level every 25 hours of operation.

SPINDLE REMOVAL AND DISASSEMBLY (Fig. 8-4, 8-5 & 8-6)

1. Remove belt covers.
2. Remove belt from spindle.
3. Remove top pulley (A) and key.
4. Remove two bolts securing cutting blade.
5. Remove 4 or 6 bolts (B) holding spindle assembly and remove spindle assembly from mower deck.
6. Remove shaft assembly from spindle housing.

SPINDLE ASSEMBLY

1. Place bearing (C) on shaft assembly.
2. Place spacer (D) on shaft assembly.
3. Place shaft assembly on spindle housing.
4. Place other bearing (E) on shaft assembly.
5. Place spindle housing assembly on mower deck and secure. Torque bolts (B) to 20.8 ft/lbs (28 Nm).
6. Assembly spindle sheave (A). Secure nut and torque to 90 ft/lbs (122 Nm).
7. Assemble blade and plate. Secure bolts with lockwashers.
8. Torque bolts to 25 ft/lbs (34 Nm).

GEAR CASE REMOVAL AND DISASSEMBLY (42" & 48" MOWERS)

1. Remove universal joint.
2. Remove the mower R.H. cover and

42" & 48" MOWERS

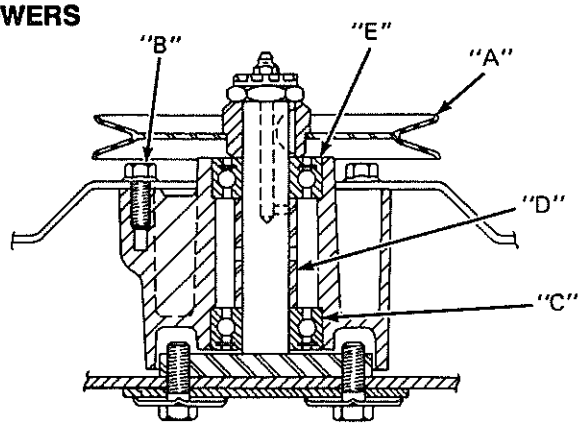


Fig. 8-4

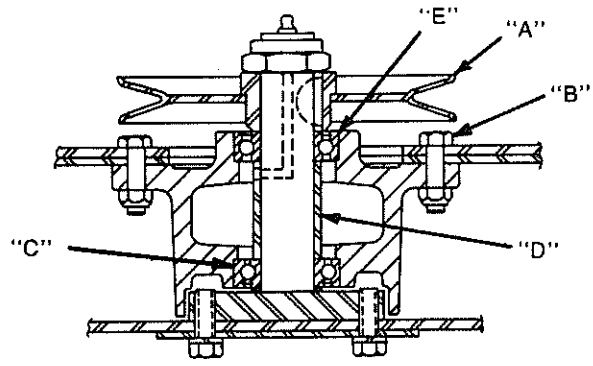


Fig. 8-5

42" & 48" MOWERS **60" MOWERS**

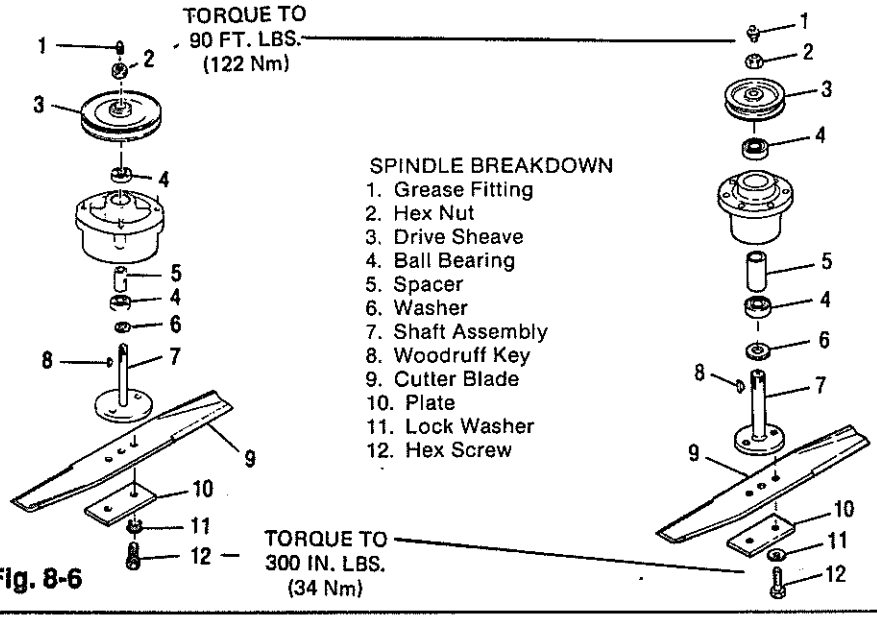


Fig. 8-6

MOWER DECKS (Continued)

disassemble the belt from the drive pulley.

3. Lift front of mower up and drain oil from case.

4. Remove gear case assembly from mower mounting bracket.

NOTE THE POSITION OF ALL THRUST AND SHIM WASHERS FOR RE-ASSEMBLY.

5. Remove output shaft (A, Fig. 8-7), as follows:

   a. Remove drive sheave (B) and woodruff key. De-burr and polish shaft to aid in re-assembly.

   b. Remove plug (C) and outside snap ring (D).

   c. Slide shaft (A), gear and bearing out of gear case.

6. Remove input shaft (E) by removing oil seal (F) and snap ring (G). Push shaft out rear of gear case.

42" & 48" GEAR CASE ASSEMBLY AND RE-INSTALLATION

1. If necessary, remove and replace all bearings and oil seals.

2. Insert input shaft (E) in case.

3. Assemble snap ring to secure shaft. The input shaft should have a maximum of .005" (0.12mm) of end play. To achieve correct end play, shim at point (H). See parts list for shim part numbers.

4. Insert output shaft (A) and gear and bearing in place and assemble outer snap ring (D). If the bearing has any end play, shim as required at point (J) to achieve a maximum of .005" (0.12 mm) clearance.

5. Check mesh of gears by turning the input shaft. The shaft should turn very freely with out excessive clearance between gear teeth. Shim as required at points (H), (J) or (K) to remove gap. See parts list for shim part numbers.

GEAR CASE ASSEMBLY

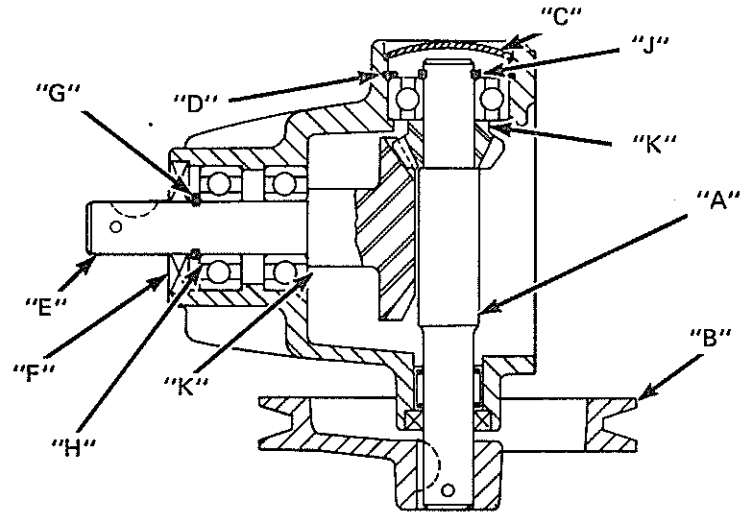
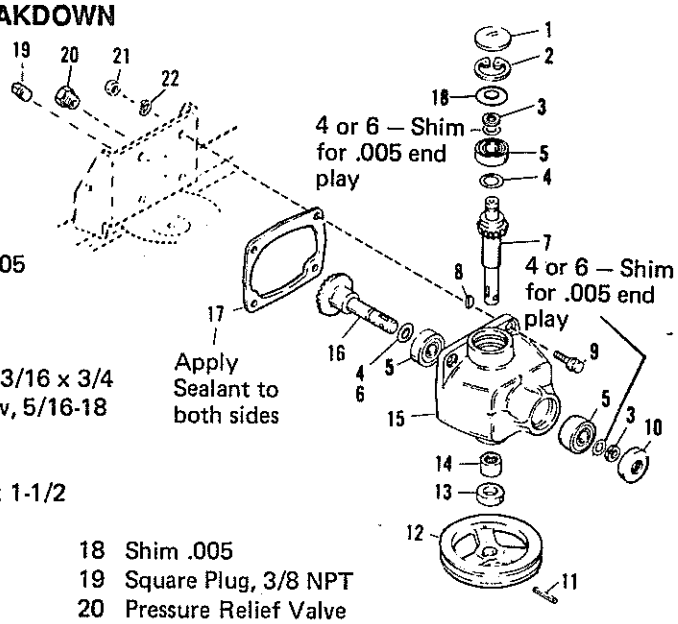


Fig. 8-7

GEAR CASE BREAKDOWN



1 Expansion Plug
2 Retaining Ring
3 Retaining Ring
4 Shim Washer .005
5 Ball Bearing
6 Shim .010
7 Output Shaft
8 Woodruff Key, 3/16 x 3/4
9 Hex Head Screw, 5/16-18 x 1-1/4
10 Oil Seal
11 Drive Pin, 1/4 x 1-1/2
12 Drive Sheave
13 Oil Seal
14 Needle Bearing
15 Gear Case
16 Bevel Gear, 26T
17 Gear Case Gasket
18 Shim .005
19 Square Plug, 3/8 NPT
20 Pressure Relief Valve
21 Lock Nut, 5/16-18
22 Lockwasher, 5/16

Fig. 8-8

6. Assemble expansion plug (C) and oil seal (F) and input seal.

7. Install drive pulley to output shaft.

8. Mount gear case assembly with gasket to mower base. Fill gear case with 11 oz. (0.32 liter) of EP90 gear lube.

9. Re-install belt and belt covers on mower.

MOWER DECKS (Continued)

GEAR CASE REMOVAL AND DISASSEMBLY (60" MOWER)

1. Remove the universal joint and idler arm spring.
2. Disassemble the gear box from the mower support and remove.
3. Remove the rear plug and drain the oil.
4. Remove drive pulley snap rings and woodruff key from output shaft (A). Remove any burrs and polish the end of shaft.
5. Remove cover (B) and output shaft assembly from case.
6. If assembly is to be disassembled, note positions of any shim washers at point (G).
7. Remove cover (D).
8. Remove roller bearing (H), and load ring (J).
9. Remove input shaft assembly (E). Check for shim washers at point (F).
10. Replace all worn parts.

GEAR CASE ASSEMBLY

1. If required, remove and replace any bearings and oil seals.
2. Insert input shaft (E) with any shim washers removed earlier in step 9 into roller bearing (F).
3. Slide on roller bearing (H) and load ring (J).
4. Secure cover in place.
5. Insert cover and input shaft assembly into case. Secure with four (4) lock washers and hex screws.
6. Torque all screws to 15-18 ft/lbs (20-24 Nm). Check gear mesh by turning input shaft. Shaft should turn very freely without excessive clearance between gear teeth. Shim as required.

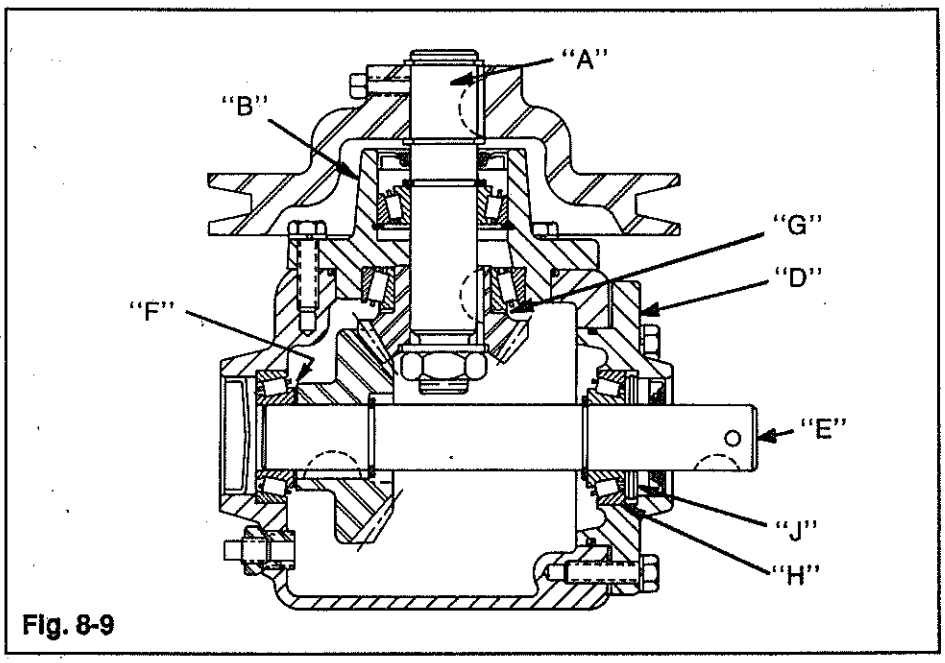
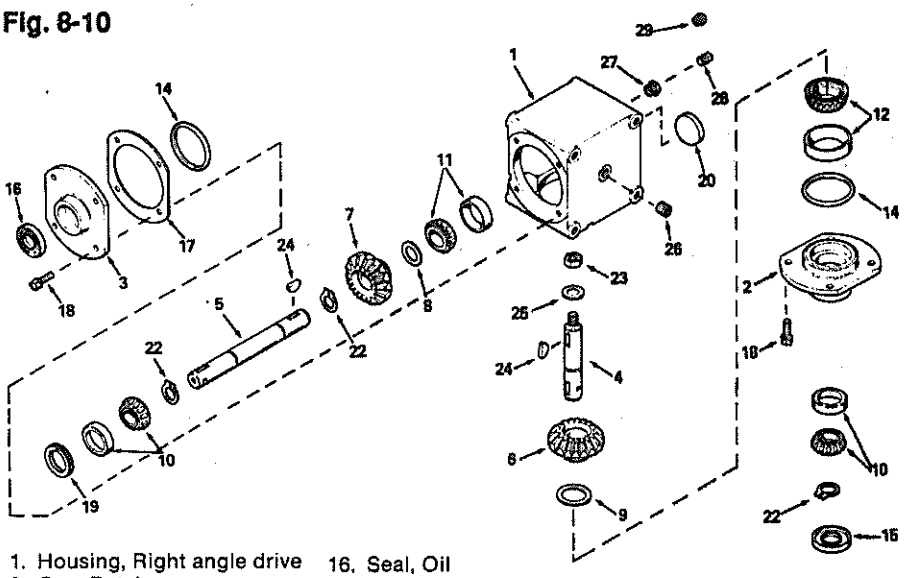


Fig. 8-9

Fig. 8-10



1. Housing, Right angle drive
2. Cap, Retainer
3. Cap, Retainer
4. Shaft, Output
5. Shaft, Input
6. Gear, Bevel (20 teeth)
7. Gear, Bevel (27 teeth)
8. Shim (1-1/2" O.D.)
9. Shim (2.000" O.D.)
10. Bearing & Cup Ass'y.
11. Bearing & Cup Ass'y.
12. Bearing & Cup Ass'y.
14. "O" Ring
15. Seal, Oil
16. Seal, Oil
17. Shim, Cap retainer
18. Screw, Hex Hd Sems 5/16 - 18 x 1
19. Ring, Load
20. Plug
22. Ring, Retaining
23. Jam Nut, 3/4 - 16
24. Key, Woodruff
25. Washer, Flat
26. Plug, Pipe, 1/4 - 18
27. Reducer, Pipe
28. Plug, Pipe
29. Valve, Relief

TILLER—Model 51333

7. Assemble drive pulley and install mower.

LUBRICATION

There are two (2) oil hole plugs in the gear case. The one located on the top front is the filler plug (A, Fig. 8-11). The recessed socket pipe plug located on the left side side-wall is the oil level plug (B). Check oil level with unit mounted on the tractor and tines resting on the ground.

This tiller is filled at the factory with Bolens EP gear lubricant or equivalent. Check oil level before initial use and every 25 hours of operation. Add lubricant as necessary to maintain proper level. If any oil leakage is noted, check oil level immediately. Inspect oil seals for wear and replace if necessary.

The capacity of this gear case is approximately 16 ounces (0.47 liters).

GEAR CASE REMOVAL

1. Remove tiller from tractor.
2. Remove RH and LH supports (C, Fig. 8-11).
3. Remove hood and hood supports (D).
4. Remove rear depth gage (E).
5. Remove nuts (F) and disassemble unit.

GEAR CASE RE-INSTALLATION

1. Reverse the above procedure.
2. Torque nuts (E) to 90 ft/lbs (122 Nm).

GEAR CASE DISASSEMBLY

1. Remove cover side woodruff key (D, Fig. 8-12) in tine shaft.
2. Remove screws and lock washers securing the case and cover together. Lift cover (A) off.
3. Remove chain connector link from chain.
4. Disassemble and remove any damaged parts.

GEAR CASE ASSEMBLY

1. See Figs. 8-12 and 8-13 for assembly. Assemble as shown.

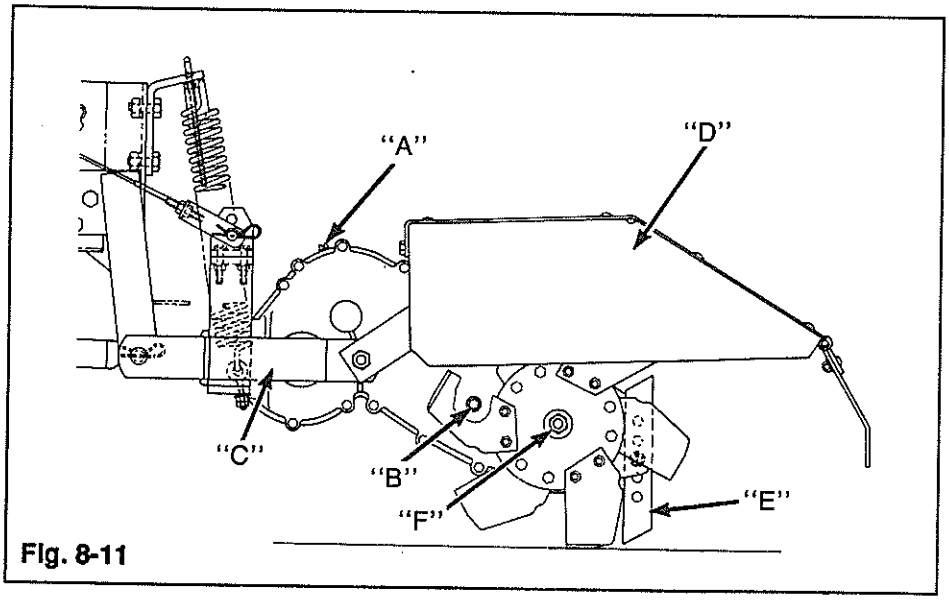


Fig. 8-11

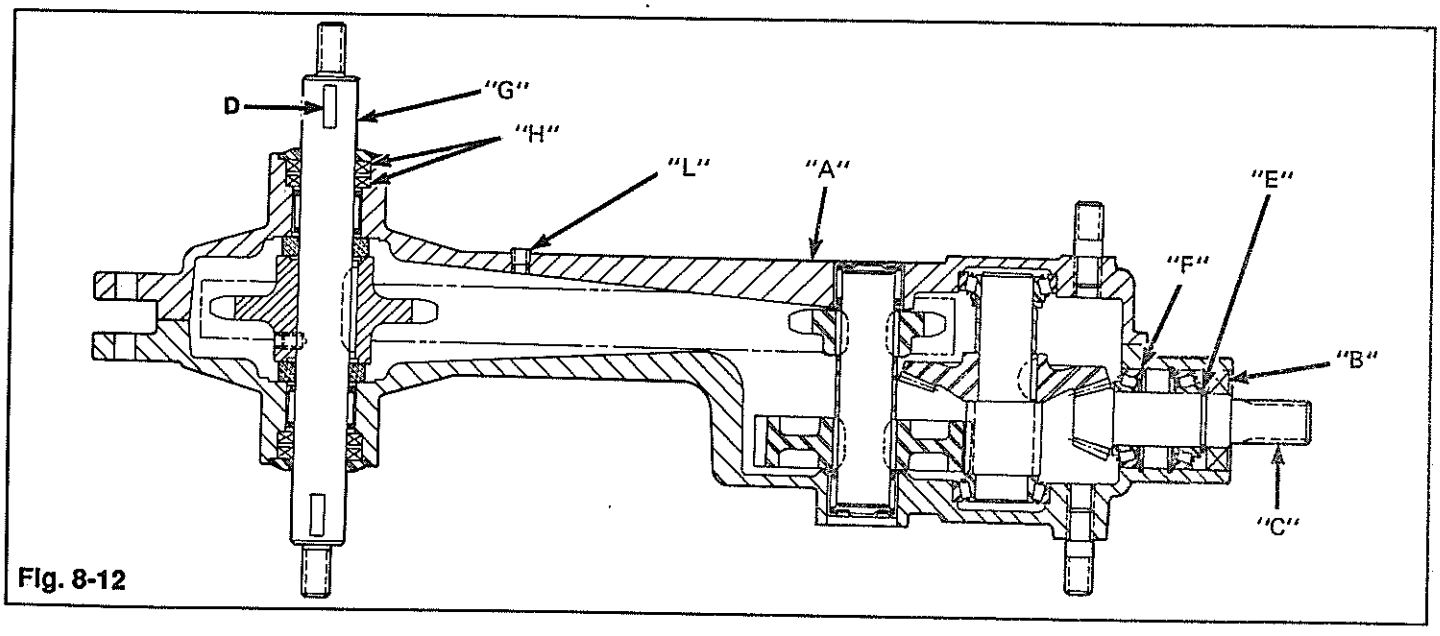
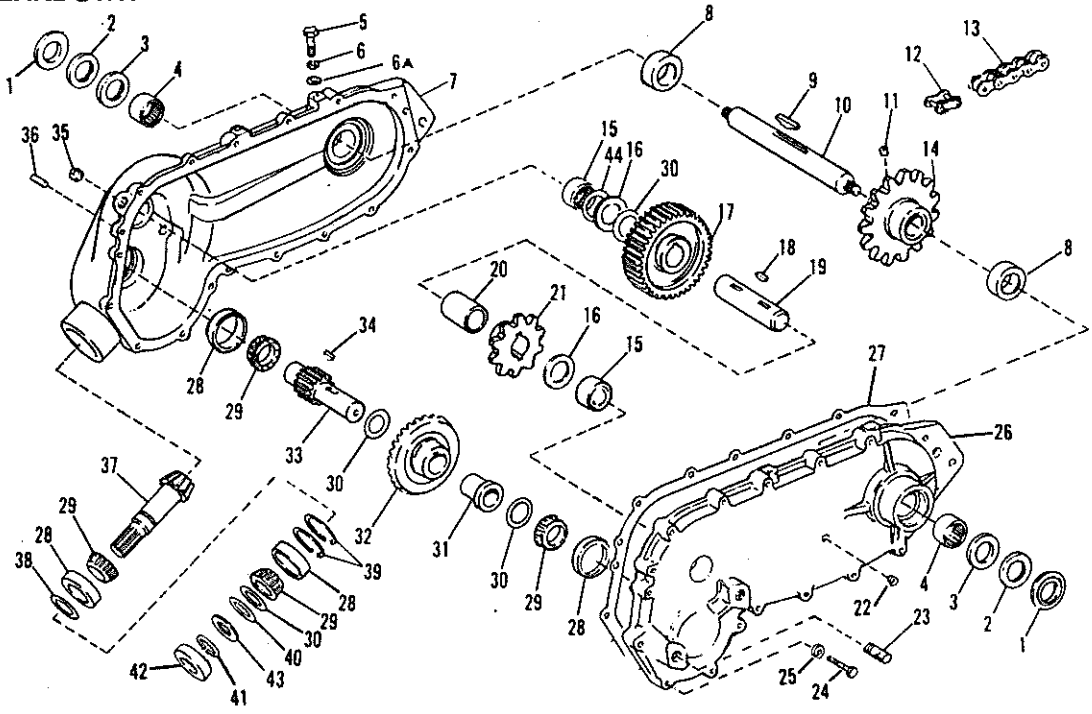


Fig. 8-12

TILLER—Model 51333 (Continued)

2. Before assembling oil seal (B, Fig. 8-12), check end play of input shaft (C) and gear (D). End play should not exceed .003" (0.07 mm). Shim if required at point (E).
3. Check backlash of gears. If gears required a lot of force to move, remove shim at point (F) and add shims at point (E). If gears are loose, remove shims at point (E) and add them at point (F). See parts list for shim part numbers.
4. Install oil seals (B).
5. When tine shaft (G) is re-assembled, pack grease between seals (H). Also apply grease to exposed shaft (G).
6. With gear case on a flat surface, fill gear case through either the top plug hole (K) or side hole (L) level with the bottom edge of hole (L) with EP 90 gear lube.

GEAR CASE BREAKDOWN



1 Seal Washer
2 Oil Seal
3 Oil Seal
4 Needle Bearing
5 Capscrew
6 Lockwasher
6A Flatwasher
7 Tiller Case
8 Thrust Washer
9 Hi-Pro Key, 5/16 x 2
10 Tine Shaft
11 Set Screw, 3/8-16 x 1/2
12 Connector, Roller Chain
13 Roller Chain, 1 Pitch
14 Sprkcet, 15 Tooth 1" Pitch
15 Needle Bearing
16 Thrust Washer
17 Gear, 39 Tooth
18 Key, 5/16 x 1-1/16
19 Shaft
20 Spacer
21 Sprocket, 10 Tooth 1" Pitch
22 Pipe Plug, 1/2 NPT
23 Stud
24 Capscrew, 5/16-18 x 2-1/4
25 Lockwasher, 5/16
26 Gear Case Cover
27 Gasket
28 Bearing Cup
29 Bearing Cone
30 Shim, .005
31 Spacer
32 Bevel Gear, 40 Tooth
33 Pinion and Shaft
34 Woodruff Key, 1/4 x 1
35 Filler Cap Assembly Pipe Plug
36 Drive Pin
37 Pinion, 13 Tooth
38 Shim, .005
39 Retaining Ring
40 Thrust Race
41 Retaining Ring
42 Oil Seal
43 Thrust Race
44 Shim, .020
NI Gear Lube EP90

Fig. 8-13

SNOWTHROWERS

MODEL 50146 GEAR BOX REMOVAL

1. Before performing any maintenance on the unit, disengage tractor PTO drive, shut engine off, allow all moving parts to come to a complete stop, and disconnect spark plug wires from spark plugs.
2. Remove attachment from tractor.
3. Remove PTO protector (chain guard).
4. Locate master link and remove. Remove chain.
5. Loosen set screws in sprocket and remove sprocket.
6. Loosen locking collar set screws. Loosen locking collar by inserting a punch in the hole in the collar and striking the punch with a hammer. The collar is an eccentric (oval) design (See Fig. 8-15). To loosen the collar, turn it in the opposite direction of normal rotation.
7. Clean all burrs and paint off driving shaft.
8. Remove screws securing gearbox support to housing (B, Fig. 8-16) and gearbox.
9. Loosen set screws on ends of auger bearing collars (C) . Remove screws securing bearings (D). Slide Collars and bearings inward against the augers (E).
10. Pull auger assembly Forward and out of housing. **NOTE: fan will have to be positioned so it will clear the housing (Fig. 8-17).**
11. Slide bearings and bearing collars off the augers.
12. Remove shear pins (F, Fig. 8-16) from augers. Mark augers with masking tape and label them left and right to aid in re-assembly. **IMPORTANT! IF AUGERS ARE ASSEMBLED INCORRECTLY, THE UNIT WILL NOT OPERATE PROPERLY!**

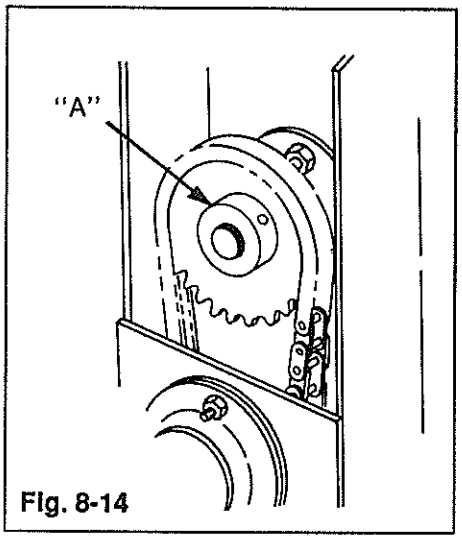


Fig. 8-14

GEAR BOX DISASSEMBLY

NOTE: BEFORE DISASSEMBLING GEARBOX, IT IS RECOMMENDED THAT ALL BURRS, PAINT AND RUST BE REMOVED FROM AUGER AND FAN SHAFT. THIS WILL AID DISASSEMBLY.

1. Remove four (4) bolts securing gear case halves together. Allow oil to drain and slide the gear case halves off the shaft.

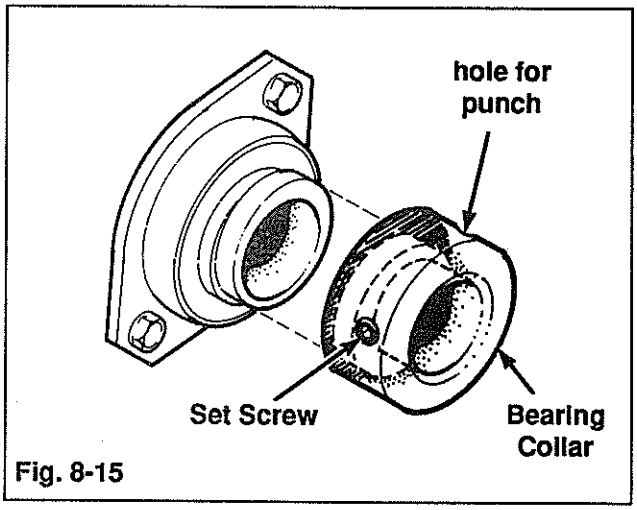


Fig. 8-15

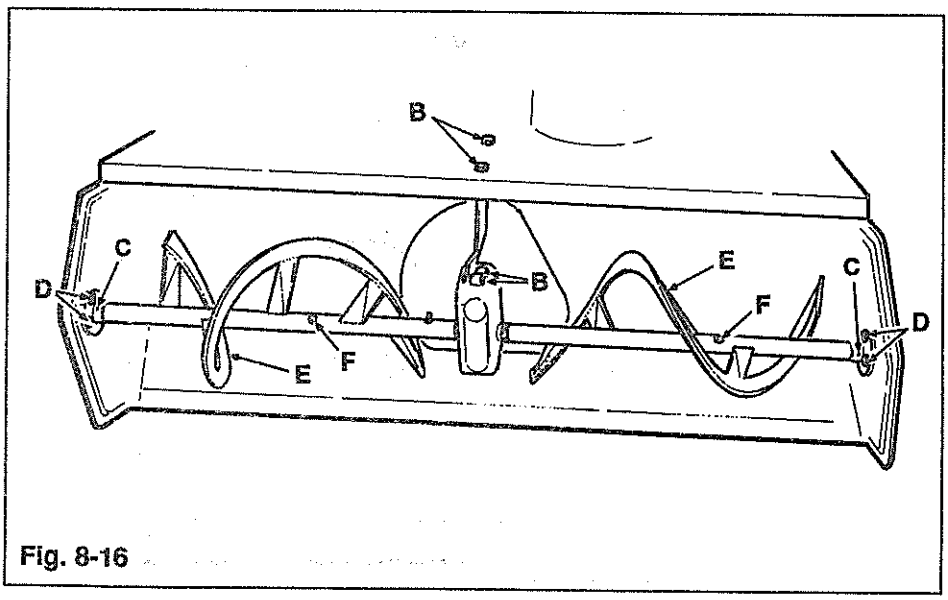


Fig. 8-16

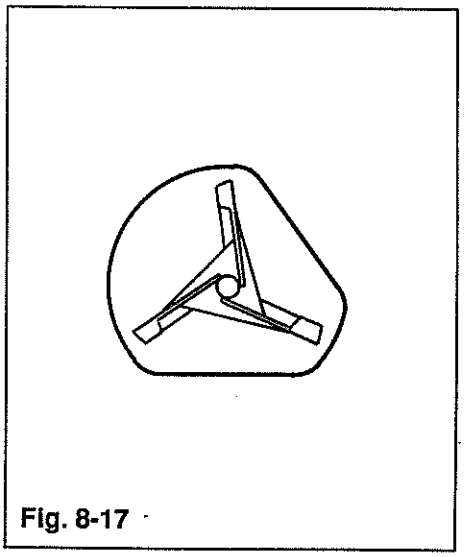


Fig. 8-17

ATTACHMENTS (Continued)

SNOWTHROWERS (Continued)

2. Remove bushings (G, Fig. 8-18) and thrust washer (H).

3. If worm requires service, remove drive pin (I) and slide worm off shaft. NOTE: ANY TIME DRIVE PIN (I) IS REMOVED, IT SHOULD BE REPLACED. Fan shaft bushing, thrust bearing and seal can be serviced without removing the worm.

4. Worm gear and thrust washers can be removed from auger shaft and serviced as necessary.

GEAR BOX RE-ASSEMBLY

NOTE: INSPECT BUSHINGS AND THRUST BEARING. INSPECT SHAFTS WHERE BUSHINGS AND SEALS RIDE. SEALS SHOULD BE REPLACED.

1. AUGER SHAFT BUSHING REPLACEMENT: lif bushing replacement is necessary, press old bushings out of gear case halves. Press in new bushings until they are flush with inside of housing.

2. FAN SHAFT BUSHING REPLACEMENT: If bushing replacement is necessary, remove old bushings by sliding bushings off the shaft. Oil new bushings and install on the fan shaft before assembling the gear case halves.

3. Install fan shaft bushings, thrust bearings and thrust washers of fans shaft.

4. Install worm gear and thrust washers on auger shaft.

5. Mesh worm with worm gear.

6. Clean mating surface of gear case halves and apply a thin bead (.010"-.25mm) of silicone sealant to each half. Also apply a bead around input cap (Fig. 8-19)

7. Slide gear case halves on auger shafts and install bolts and fasten gear case together. NOTE: Care must be taken to properly align gears, input cap and bushings with housing. DO NOT FORCE HOUSING TOGETHER WITH BOLTS— HOUSING SHOULD FIT TOGETHER EASILY.

8. Using a seal protector, grease and install fan and auger shaft seals.

9. Grease shaft and install fan assembly.

10. Grease shaft and install right and left-hand augers. NOTE: BE SURE TO INSTALL AUGERS PROPERLY! **IF AUGERS ARE ASSEMBLED INCORRECTLY, THE UNIT WILL NOT OPERATE PROPERLY!** (Refer to step 12, " GEAR BOX

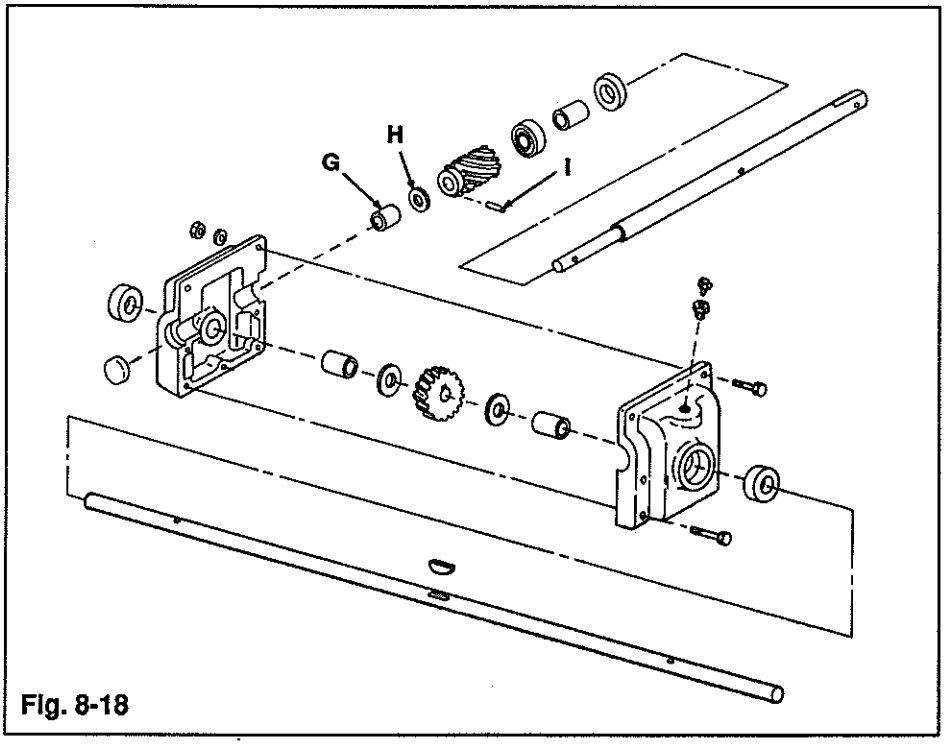


Fig. 8-18

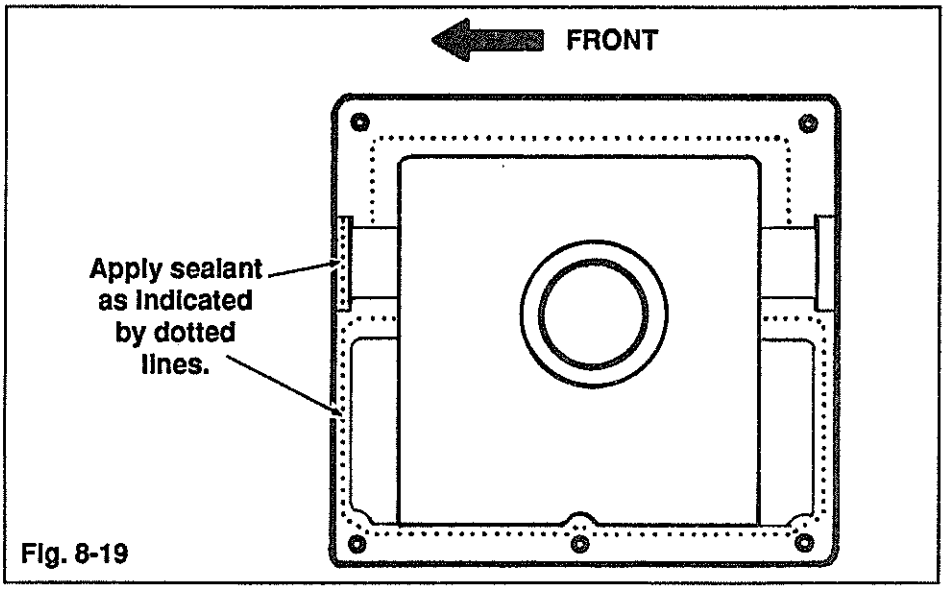


Fig. 8-19

SNOWTHROWERS (Continued)

11. Install assembly in blower housing.

12. Fasten auger shaft bearings to housing. NOTE: DO NOT TIGHTEN BEARING COLLAR SET SCREWS UNTIL BOTH BEARINGS AND THE GEAR CASE SUPPORT ARE INSTALLED AND TIGHTENED. Secure center gear case support to gear case and housing. Now, tighten bearing collar set screws.

13. Install fan bearing lock collar. Tighten the collar with a hammer and punch in the same direction as the shaft rotation. Tighten fan bearing lock collar set screw.

14. Install chain and chain guard (PTO protector).

15. Fill gear case with SAE 90 to the bottom edge of the fill hole. Check for leaks.

NOTE: Check chain tension and oil level after first hour of use.

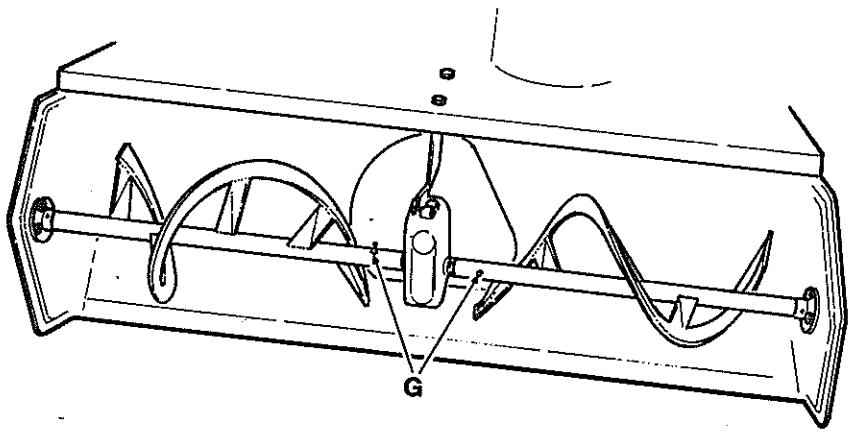


Fig. 8-20

MAINTENANCE

GEARBOX—Check oil level every 10 hours. Fill if necessary with EP90 extreme pressure oil.

AUGER SHAFT—Grease each shaft at fittings (G, Fig. 8-20)) every 24 hours of use.

DRIVE CHAIN—Lubricate chain with chain saw oil after each use.

MOVING PARTS—Oil rotating parts and bearings with multi-purpose oil every 24 hours of use.

SNOWTHROWERS (Continued)

GEAR CASE BREAKDOWN

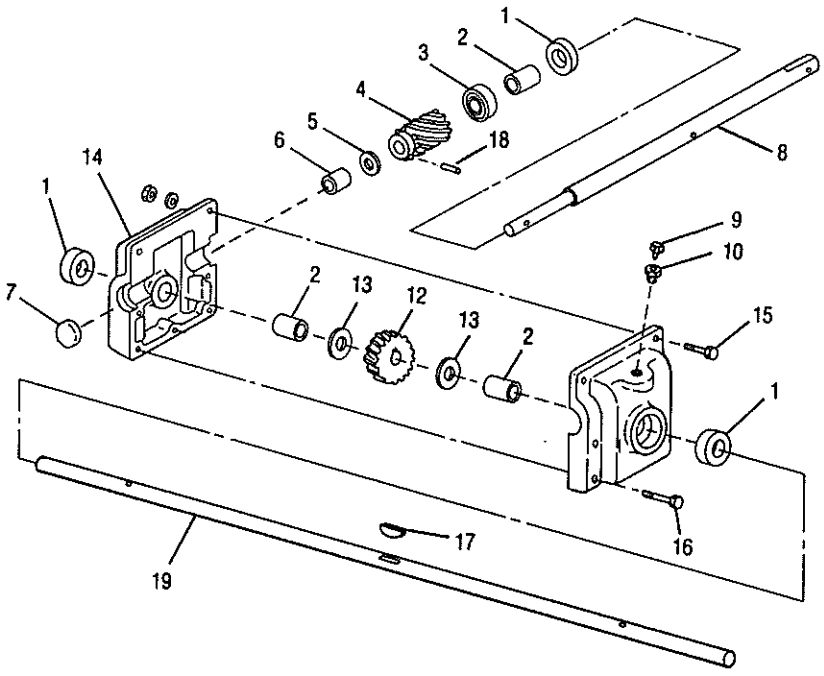


Fig. 8-16

1. Oil Seal CR 9818
2. Bushing (1" int. dia x 1-1/4" ext. dia. x 1" long)
3. Bearing SKF #51105
4. Worm RH Rotation
5. Washer (1-3/8" dia)
6. Bushing (7/8" int. dia. x 1-1/8" ext. dia. x 1" long)
7. Input Cap
8. Input Shaft
9. Breather (1/8" NPT)
10. Coupling (3/8" NPT Male x 1/8" NPT Female)
11. Cover (RH)
12. Bronze Gear
13. Washer (1-1/2" dia.)
14. Cover (LH)
15. Bolt (5/16" NC x 1-1/4" Gr. 5)
16. Bolt (5/16" NC x 2-1/2" , Gr. 5)
17. Key (Woodruff)
18. Pin
19. Output Shaft