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***Bolens***<sup>®</sup>

**QS, QT & 1900  
Series  
Tractors**

**SERVICE  
MANUAL**

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# QS, QT & 1900 Series Tractors

I. GENERAL

1

II. ELECTRICAL SYSTEM

2

III. DRIVE CHAIN

3

IV. FUEL SYSTEM

4

V. CHASSIS

5

VI. HYDRAULIC SYSTEM

6

VII. ENGINE

7

VIII. TRACTOR ATTACHMENTS

8

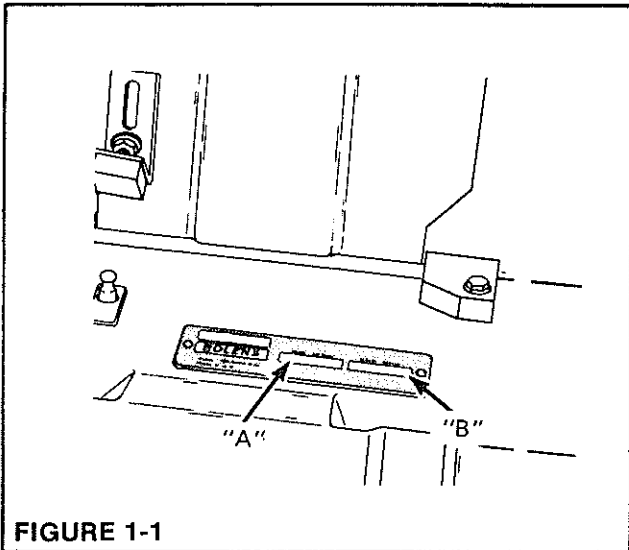
	PAGE		PAGE
<b>GROUP I. GENERAL.....</b>	<b>1-1</b>	<b>GROUP III. DRIVE TRAIN.....</b>	<b>3-1</b>
SERIAL NUMBER INFORMATION ..	1-1	TROUBLESHOOTING GUIDE.....	3-1
SPECIFICATIONS .....	1-2	PRINCIPLE OF OPERATION .....	3-2
MAINTENANCE CHART.....	1-4	HYDROSTATIC TRANSMISSION	
LUBRICATION POINTS .....	1-5	FLOW CHART .....	3-3
LUBRICATION CHART.....	1-6	HYDROSTATIC IDENTIFICATION ..	3-4
<b>GROUP II. ELECTRICAL SYSTEM.....</b>	<b>2-1</b>	TESTING HYDRO .....	6-3
TROUBLESHOOTING GUIDE.....	2-1	TRANSAXLE REMOVAL (EATON) ..	3-7
ELECTRICAL WIRE COLOR GUIDE ..	2-3	TRANSAXLE REMOVAL	
WIRING DIAGRAM 1660 S/N 0100101		(SUNSTRAND).....	3-8
THRU 0199999 .....	2-4	HYDRO REMOVAL.....	3-9
WIRING DIAGRAM 1660 S/N 0200101		HYDRO REPAIR (EATON).....	3-10
AND LATER .....	2-5	HYDRO REPAIR (SUNSTRAND) ...	3-11
START AND RUN CIRCUIT 1660. ...	2-5	TRANSAXLE .....	3-22
LIGHT CIRCUIT 1660 S/N 0100101		OIL SEAL INSTALLATION.....	3-25
THRU 0199999 .....	2-6	BEARING INSTALLATION.....	3-28
LIGHT CIRCUIT 1660 S/N 0200101		HYDRO INSTALLATION .....	3-29
AND LATER .....	2-7	TRANSAXLE REINSTALLATION	
CHARGING CIRCUIT 1660 0100101		(EATON) .....	3-31
THRU 0199999 .....	2-6	TRANSAXLE REINSTALLATION	
CHARGING CIRCUIT 1660 0200101		(SUNSTRAND).....	3-32
AND LATER .....	2-7	<b>GROUP IV. FUEL SYSTEM.....</b>	<b>4-1</b>
WIRING DIAGRAM 1666 S/N 0100101		TROUBLESHOOTING GUIDE.....	4-1
THRU 0499999 .....	2-8	SERVICING .....	4-2
WIRING DIAGRAM EARLY MODELS		FUEL VALVE .....	4-2
1666 SERIAL NO'S 0600101 THRU	2-9	DUEL VALVE .....	4-2
WIRING DIAGRAM EARLY MODELS		FUEL FILTER .....	4-2
1666 SERIAL NO'S 0600101 THRU		AIR CLEANER.....	4-3
0799999 .....	2-10	CARBURETOR ADJUSTMENTS.....	4-4
WIRING DIAGRAM 1666 S/N 0600101		<b>GROUP V. CHASSIS .....</b>	<b>5-1</b>
AND LATER .....	2-11	STEERING ASSEMBLY.....	5-1
LIGHT CIRCUIT 1666 S/N 0100101		HYDROSTATIC ADJUSTMENTS ...	5-4
THRU 0499999 .....	2-12	BRAKE ASSEMBLY.....	5-5
LIGHT CIRCUIT 1666 S/N 0500101		INTERLOCK SWITCHES.....	5-6
AND LATER .....	2-12	POWER TAKE-OFF (P.T.O.) .....	5-7
START RUN CIRCUIT 1666		<b>GROUP VI. HYDRAULIC SYSTEM.....</b>	<b>6-1</b>
S/N 0100101 THRU 0499999 .....	2-13	TROUBLESHOOTING GUIDE.....	6-1
START RUN CIRCUIT 1666		TESTING HYDRAULIC SYSTEM ...	6-3
S/N 0500101 AND LATER .....	2-13	HYDRAULIC POWER LIFT.....	6-5
CHARGING CIRCUIT 1666 S/N		<b>GROUP VII. ENGINE.....</b>	<b>7-1</b>
0100101 THRU 0499999.....	2-14	TROUBLESHOOTING GUIDE.....	7-1
CHARGING CIRCUIT 1666 S/N		QT-16 ONAN ENGINE.....	7-3
0500101 THRU 0599999.....	2-14	QS-16 KOHLER ENGINE .....	7-4
CHARGING CIRCUIT 1666 S/N		QT-17 KOHLER ENGINE .....	7-5
0600101 AND LATER.....	2-15	<b>GROUP VIII. TRACTOR ATTACH-</b>	
PTO CLUTCH CIRCUIT 1666 S/N		<b>MENTS .....</b>	<b>8-1</b>
0100101 THRU 0499999.....	2-15	MOWER DECKS .....	8-1
PTO CLUTCH CIRCUIT 1666 S/n		SNOW THROWERS .....	8-5
0500101 THRU 0599999.....	2-16	TILLERS .....	8-7
PTO CLUTCH CIRCUIT 1666 S/N			
0600101 AND LATER.....	2-16		
SEAT SWITCH CIRCUIT 1666 S/N			
0500101 AND LATER.....	2-17		
TESTING ELECTRICAL SYSTEM... ..	2-18		

## GROUP I. GENERAL

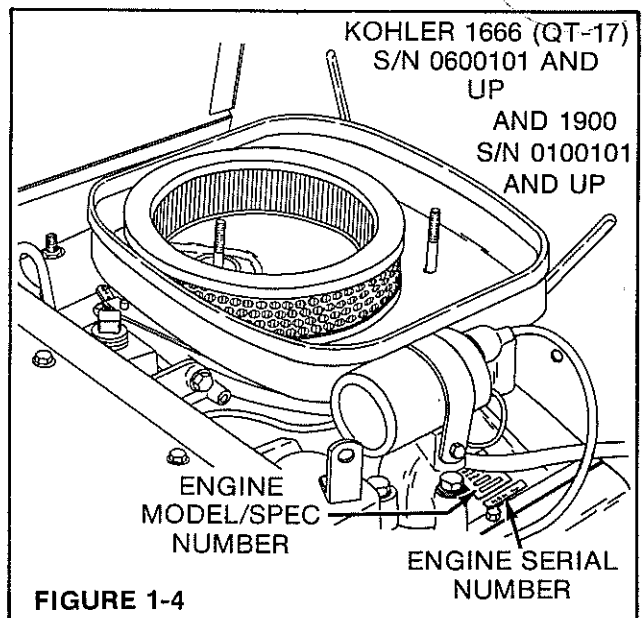
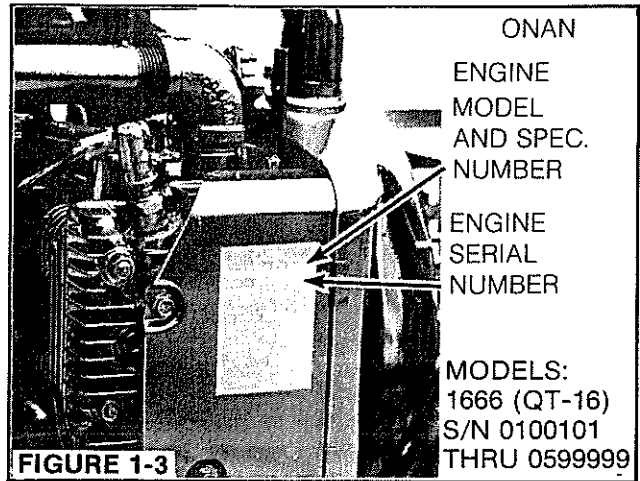
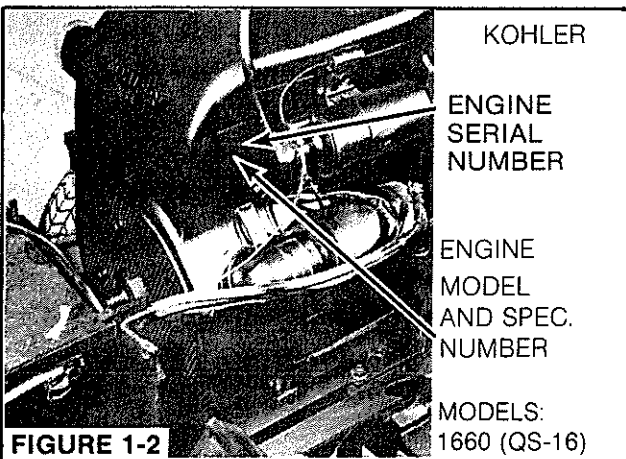
QS, QT & 1900 SERIES  
TRACTORS  
Page 1-1 REV. 4/83

### SERIAL NUMBER INFORMATION

Model number of Tractor. A.  
Serial number of Tractor. B.



Engine Model Number.  
Engine Serial Number.  
Engine Spec. Number.



## GENERAL (Continued)

### SPECIFICATIONS

KOHLER ENGINE	MODEL 1660	MODEL 1666 (SERIAL NO'S) 0600101 AND LATER)
Manufacturer .....	<u>Kohler</u>	<u>Kohler</u>
Model/Spec .....	K-341 AQS Spec. 71172A & 71176A .....	KT 17QS Spec. 24106A, 24152 & 24197
Type .....	Horz. shaft, air cooled 1 cyl., 4 cycle ....	Horz. shaft, air cooled 2 cyl., 4 cycle
Bore and Stroke ..	3-3/4" (95 mm) x 3-1/4" (82.5 mm) .....	3-1/8" (79 mm) x 2-3/4" (70 mm)
Piston		
Displacement .....	35.89 cu. In. (587 cc) .....	42.18 cu. In. (690 cc)
Mfr's H.P. Rating ..	16 H.P. at 3600 RPM .....	17 H.P. at 3600 RPM
Air Cleaner .....	Paper Element Kohler 4708301 .....	Paper Element Kohler 4708301
Oil Capacity .....	1-1/2 Quarts (1.4 liter) .....	3 Pints (1.4 liter)
Governor .....	Mechanical .....	Mechanical
Speed Control ....	Remote cable operated .....	Remote, cable operated
Starter .....	Bendix Type .....	Bendix Type
Charging System ..	15 Amp. flywheel Alternator .....	15 Amp. flywheel Alternator
Spark Plug Size ...	14 mm .....	14 mm
Spark Plug .....	Champion H10 .....	Champion RBL15Y
Spark Plug Gap ...	.025 (0.63 mm) .....	.025 (0.63 mm)
Breaker Point Gap	.020 (0.5 mm) .....	.020 (0.5 mm)
Timing .....	S Mark In Timing Hole .....	SP Mark in Timing Hole

ENGINE	MODEL 1966 (SERIAL NO'S) 0100101 AND LATER)
Manufacturer ....	Kohler
Model/Spec .....	KT 19QS Spec. 49139
Type .....	Horz. shaft, air cooled 2 cyl., 4 cycle
Bore and Stroke ..	3-1/8" (79 mm) x 3-1/16 (78.0 mm)
Piston	
Displacement ....	47 cu. in. (770 cc)
Mfr's H.P. Rating	19 H.P. at 3600 RPM
Air Cleaner	Paper Element Kohler 4508302 with Precleaner 5208302
Oil Capacity .....	1-1/2 Qts. (1.42 liter)
Governor .....	Mechanical
Speed Control ...	Remote, cable operated
Starter .....	Bendix Type
Charging System ..	15 Amp. flywheel Alternator
Spark Plug Size ..	14 mm
Spark Plug .....	Champion RBL15Y
Spark Plug Gap ...	.025 (0.63 mm)
Breaker Point Gap	.020 (0.5 mm)
Timing .....	SP Mark in Timing Hole

## GENERAL (Continued)

QS, QT & 1900 SERIES  
TRACTORS  
Page 1-3 REV. 4/83

### SPECIFICATIONS

#### ONAN ENGINE

MODEL 1666 (SERIAL NO'S  
0100101 THRU 0599999)

Manufacturer ..... Onan

Model/Spec ..... BF/MS Spec. 2425 A thru C, 2938 D &  
E & 3283 F

Type ..... Horz. shaft, air cooled, 2 cyl., 4 cycle

Bore and Stroke ..... 3-1/8" (79 mm) x 2-5/8" (66.6 mm)

Piston Displacement ..... 40.3 cu. In. (660 cc)

Mfr's H.P. Rating ..... 16 H.P. at 3600 RPM

Air Cleaner ..... Paper Element B140-1216

Oil Capacity ..... 2 Quarts (1.9 liter)

Governor ..... Mechanical

Speed Control ..... Remote, cable operated

Starter ..... Bendix Type

Charging System ..... 15 Amp. flywheel alternator

Spark Plug Size ..... 14 mm

Spark Plug ..... Champion H8

Spark Plug Gap ..... .025 (0.63 mm)

Breaker Point Gap ..... .020 (0.5 mm)

Timing ..... 25° B.T.D.C.

#### CHASSIS

Type ..... Steel, formed frame

Length ..... 70-1/2 in. (179 cm)

Width - With Terra Tires ..... Wheels turned in - 30-1/4 in. (76.8 cm)

Wheels turned out - 40-1/2 in. (103 cm)

Height ..... 45 in. (114 cm)

Wheel Base ..... 48-1/2 in. (123 cm)

Turning Radius ..... 59 in. (150 cm)

Ground Clearance - Transaxle Center ..... 7-1/2 in. (19 cm)

Shipping Weight ..... 850 lbs./ (385 kg)

Transmission ..... (1660 & 1666 series 0100101 thru 0499999 - Sundstrand In-Line)

(1666 Series 0500101 and later, 1966 - Model 11 Eaton)

Transmission Oil Capacity ..... 10 Quarts

Speed Infinitely Variable ..... Forward - 0-8 mph (0-12.8 km/hr)

Reverse - 0-4 mph (0-6.4 km/hr)

Brakes ..... Disc

## GENERAL (Continued)

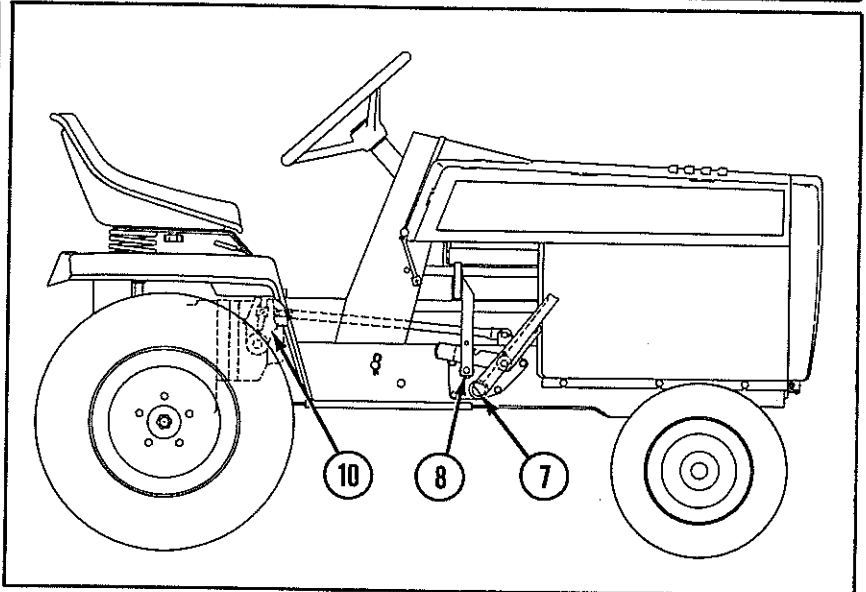
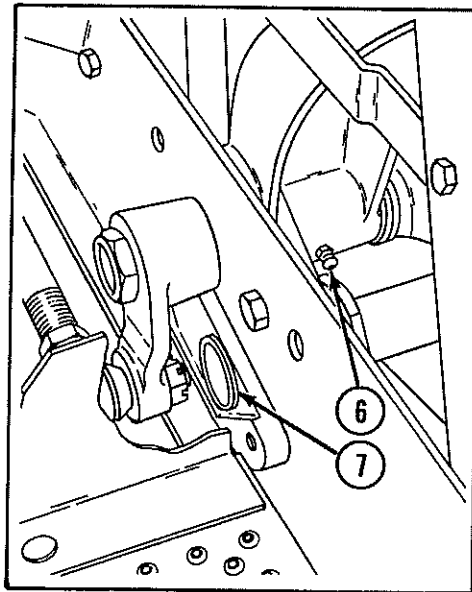
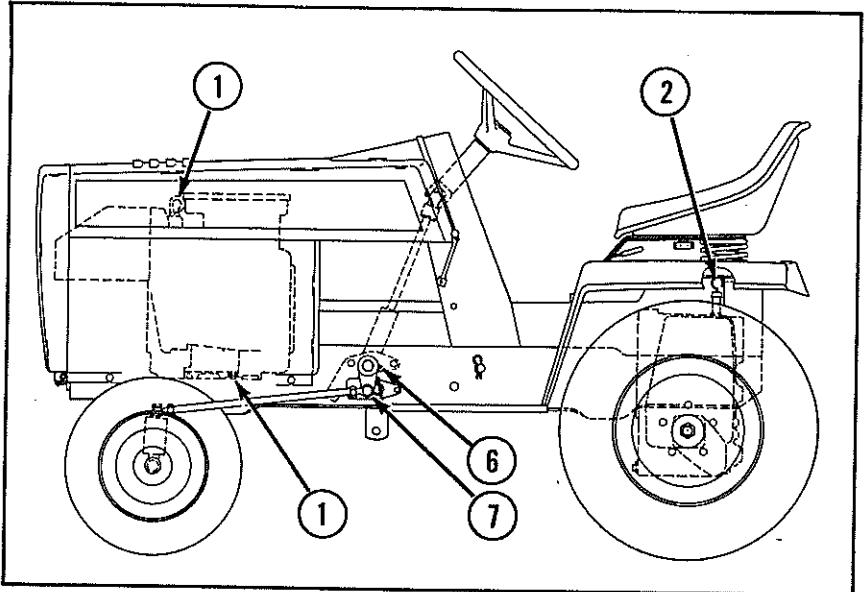
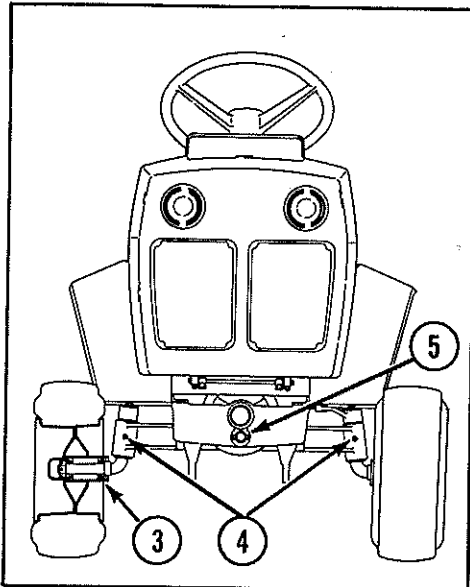
### MAINTENANCE CHART

MAINTENANCE REQUIRED	Length of Operation	Type of Maintenance
Engine Cooling Air Screen —	Daily or 10 Hrs.*	Brush Clean
Engine Air Cleaner —	50 Hrs.*	Shake Out Dirt
	25 Hrs.	Clean Precleaner (if equipped)
	100 Hrs.*	Replace Element
Cooling Fins — (Engine) —	Daily or 100 Hrs.	Clean — Use Air Hose if Available
Spark Plugs —	100 Hrs.	Service or Replace
Breaker Points —	200 Hrs.	Service or Replace
Ignition Timing —	100 Hrs.	Adjust
Engine Valve Tappets —	400 Hrs.	Adjust
Power-Take-Off — 1666 S/N 0200101 and later 1660 1966	100 Hrs.*	Check and Adjust Brake
Fuel Filter —	100 Hrs.	Clean if two piece, replace if one piece
Battery —	Daily	Check electrolyte level - Add water as Necessary
Hydrostatic Transmission —	50 Hrs.*	Clean — Use Air Hose if Available
Belts —	50 Hrs.*	Check for Wear and Adjust
Tires —	25 Hrs.	Check for Damage and Air Pressure
Transmission Filter —	After First 5 Hours then After Every 100 Hrs.*	Change and Add oil to Bring to Operating Level (Use only Bolens Filter)
Brakes —	50 Hrs.*	Check for wear and Adjust

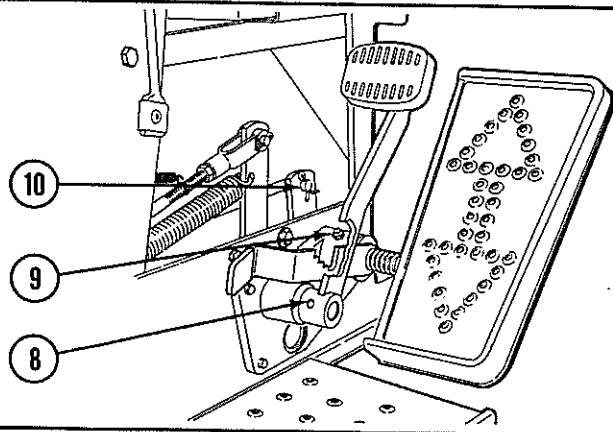
\*More often under extreme conditions.

## GENERAL (Continued)

QS, QT & 1900 SERIES  
TRACTORS  
Page 1-5 REV. 4/83



MODEL  
1966  
SHOWN





## GENERAL (Continued)

### LUBRICATION CHART

LUBRICATION REQUIRED		Length of Operation	Type of Lubrication	Amount Required
1. Engine Crankcase —		Daily & 10 Hrs.	Engine Oil	Add Oil To Full Mark
Average Temperature	(Spring, Summer, Autumn) (+120° F. to 30° F) 49° F to -1° C	Onan 50 Hrs.*	SAE 30 Oil Type SE-SC	Replace Onan 2 Qts(1.9 liter)  Kohler (K 341) 1-1/2 Qts. (1.4 liter)  Kohler (KT 17) 3-1/2 pints (1.7 liter) Kohler (KT 19) 1-1/2 Qts. (1.4 liter)
		Kohler 25 Hrs.*	SAE 10W30 or 10W40 TYPE SC, CC, SD or SE	
	(Winter) (+30° ro 0° F.) -1° C to -18° C	Onan 50 Hrs.*	SAE 10W30 Oil TYPE SE-CC	
		Kohler 25 Hrs*	SAE 5W30 or 5W20 TYPE SC, CC, SD or SE	
	(Winter) (Below 0° F.) Below -18° C	Onan 50 HRS.*	SAE 5W-20 Oil TYPE SE-CC	
		Kohler 25 Hrs.*	SAE 5W-30 or 5W20 TYPE SC, CC, SD or SE	
2. Hydrostatic Transmission — (Capacity 10 qts.)		Check Weekly Or 30 Hrs.	With Sunstrand Hydro's Type "F" Automatic Transmission Fluid	Level must be maintained in the operating zone
			With Eaton Hydro's SAE 20, Oil	
		When Oil is Discolored	Drain and refill with: (Type "F" Automatic Transmission Fluid with Sunstrand Hydros) (SAE 20 Oil with Eaton Hydros)	
3. Front Wheel Bearings —		Once a year	Wheel Bearing Grease	Pack
4. Front Wheel Spindles —		30 Hrs. Or Once a Year	Grease With Multi Purpose **	1-2 Strokes
5. Front Axle Pivot —		30 Hrs. Or Once a Year	Grease With Multi Purpose **	1-2 Strokes
6. Steering Shaft —		30 Hrs. Or Once a Year	Grease With Multi Purpose **	1-2 Strokes
7. Pivot Shaft —		30 Hrs.	Oil	Small Amount
8. Brake Linkage —		30 Hrs.	Oil	Small Amount
9. Travel Pedal Shaft —		30 Hrs. Or Once a Year	Oil	Small Amount
10. Hydrostatic Control Arms —		30 Hrs.	Light Machine Oil	Small Amount

\*More often under extreme conditions.

\*\*Or equivalent

NOTE: A hand grease gun is recommended when greasing your unit. Lubricate all linkages, levers, and pins not equipped with grease fittings with an oil can once a week, or oftener depending on operating conditions.

**TROUBLE SHOOTING GUIDE****2**

PROBLEM	PROBABLE CAUSE	REMEDY
Starter Motor does not energize and solenoid does not click.	<ol style="list-style-type: none"><li>1. Attachment drive engaged.</li><li>2. Brake pedal not depressed.</li><li>3. Corroded or loose electrical solenoid connections.</li><li>4. Inoperative switches - Attachment drive, brake and key switch.</li><li>5. Inoperative key switch.</li><li>6. Defective key switch.</li></ol>	<ol style="list-style-type: none"><li>1. Disengage PTO.</li><li>2. Depress brake pedal.</li><li>3. Clean and tighten Red/White wire at solenoid.</li><li>4. Check and replace if necessary. (Refer to switch testing.)</li><li>5. Check and replace if necessary. (Refer to solenoid testing.)</li><li>6. Check and replace if necessary. (Refer to ignition switch test.)</li></ol>
Starter Motor does not energize but solenoid clicks.	<ol style="list-style-type: none"><li>1. Discharged battery.</li><li>2. Corroded or loose electrical connections on solenoid, or starter.</li><li>3. Inoperative solenoid.</li></ol>	<ol style="list-style-type: none"><li>1. Charge battery.</li><li>2. Check solenoid or starter.</li><li>3. Check and replace if necessary.</li></ol>
Engine cranks slowly.	<ol style="list-style-type: none"><li>1. Weak or discharged battery.</li><li>2. Corroded or loose electrical connections at battery.</li></ol>	<ol style="list-style-type: none"><li>1. Check battery, charge or replace if necessary.</li><li>2. Clean and tighten.</li></ol>
Battery discharges rapidly.	<ol style="list-style-type: none"><li>1. Low water level.</li><li>2. Inoperative battery.</li></ol>	<ol style="list-style-type: none"><li>1. Check and refill.</li><li>2. Check and replace if necessary.</li></ol>
Battery will not charge.	<ol style="list-style-type: none"><li>1. Corroded or loose battery cables.</li><li>2. Inoperative battery.</li><li>3. Inoperative diode or rectifier/regulator.</li></ol>	<ol style="list-style-type: none"><li>1. Clean and tighten.</li><li>2. Replace battery.</li><li>3. Check diode and replace if necessary. Check rectifier/regulator by substitutions. (Refer to diode test.)</li></ol>

## ELECTRICAL SYSTEM (Continued)

### TROUBLE SHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	REMEDY
Lights not operating.	<ol style="list-style-type: none"> <li>1. Bulbs burned out.</li> <li>2. Loose or poorly connected white wires or poor black ground wire.</li> <li>3. Bad light switch.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace.</li> <li>2. Install properly and tighten.</li> <li>3. Check.</li> </ol>
Attachment drive inoperative (Attachment drive light works). (QT-1666 & 1966 series only)	<ol style="list-style-type: none"> <li>1. Broken or loose wires.</li> <li>2. Inoperative electric clutch.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check purple wire between PTO switch and electric clutch.</li> <li>2. Replace.</li> </ol>
Attachment drive inoperative (Attachment light inoperative). (QT-1666 & 1966 series only)	<ol style="list-style-type: none"> <li>1. Inoperative Attachment drive switch.</li> <li>2. Broken red wire between Attachment drive switch and key switch.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and replace of necessary. Refer to Attachment switch test.</li> <li>2. Check and replace of necessary.</li> </ol>
Engine kills when Attachment drive switch is turned on.	<ol style="list-style-type: none"> <li>1. No operator in seat.</li> <li>2. Seat switch is not adjusted properly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Seat switch must be activated either by operator in seat or the interlock switch button pulled up.</li> <li>2. Adjust so switch is engaged when operator is seated.</li> </ol>
Continued operation of attachments when operator is not seated. (1666-0500101 and later)(1966)	<ol style="list-style-type: none"> <li>1. Seat switch is not adjusted correctly.</li> <li>2. Inoperative seat switch.</li> <li>3. Broken seat switch wires.</li> <li>4. Inoperative Attachment drive switch. (QT 1666 Series only)</li> <li>5. Inoperative condensor.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust so switch is disengaged when operator is not seated.</li> <li>2. Check and replace if necessary. Refer to seat switch test.</li> <li>3. Connect or repair blue wires between seat switch and Attachment drive switch.</li> <li>4. Check and replace if necessary. Refer to Attachment drive switch test.</li> <li>5. Check and replace if necessary.</li> </ol>

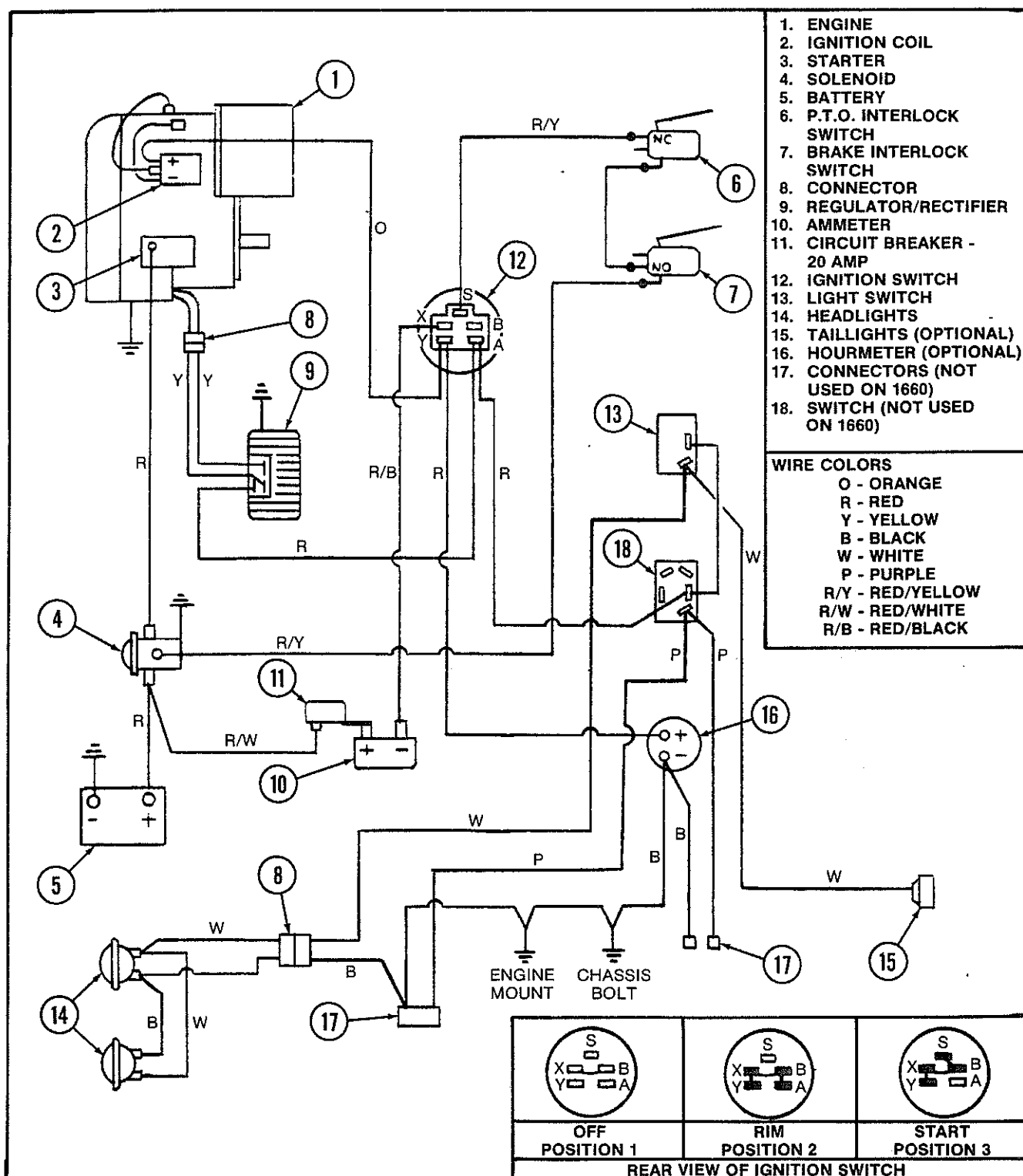
**ELECTRICAL SYSTEM WIRE COLOR CODE**

<u>COLOR</u>	<u>FUNCTION</u>	<u>EXPLANATION</u>
Black	Ground	—
Black/Yellow	Solenoid Ground	Lead between solenoid and ground switch
Red	Switched 12 Volts	"Run" or "On" Key Position
Red/White	Amp Meter Pos. Terminal	For Amp Meter polarity indication
Red/Black	Amp Meter Neg. Terminal	Amp Meter polarity indication
Red/Yellow	Start Circuit	12 Volts start position only
Orange	Ignition Circuit	12 Volts during run and start position
Yellow	Stator Leads	—
Yellow/Red	Stator Leads	To indicate polarity on 2nd wire
Blue	Stop Circuit	From engine kill circuit
Blue/Black	Safety Interlock	Accessory Stop Circuit
White	Lights	—
White/Green	Hi Beam	Function of light circuit
White/Blue	Lo Beam	Function of light circuit
White/Red	Brake Light	Function of light circuit
White/Black	Back Up Light	Function of light circuit
Brown	Tach	—
Brown/Orange	Tach Signal	Obtained from 12 volt ignition coil
Brown/Yellow	Tach Signal	Obtained from stator
Purple	P.T.O. Clutch	—
Green	Temperature	Lead used between sender and indicator
Gray	Oil Pressure	Lead used between sender and indicator

Some of the products from Vendors will not match our color system. Generally the Vendor uses black wire; however, we will try to interrupt this difference by using a connector located near the Vendor item.

# ELECTRICAL SYSTEM (Continued)

## WIRING DIAGRAM 1660 S/N 0100101 THRU 0199999

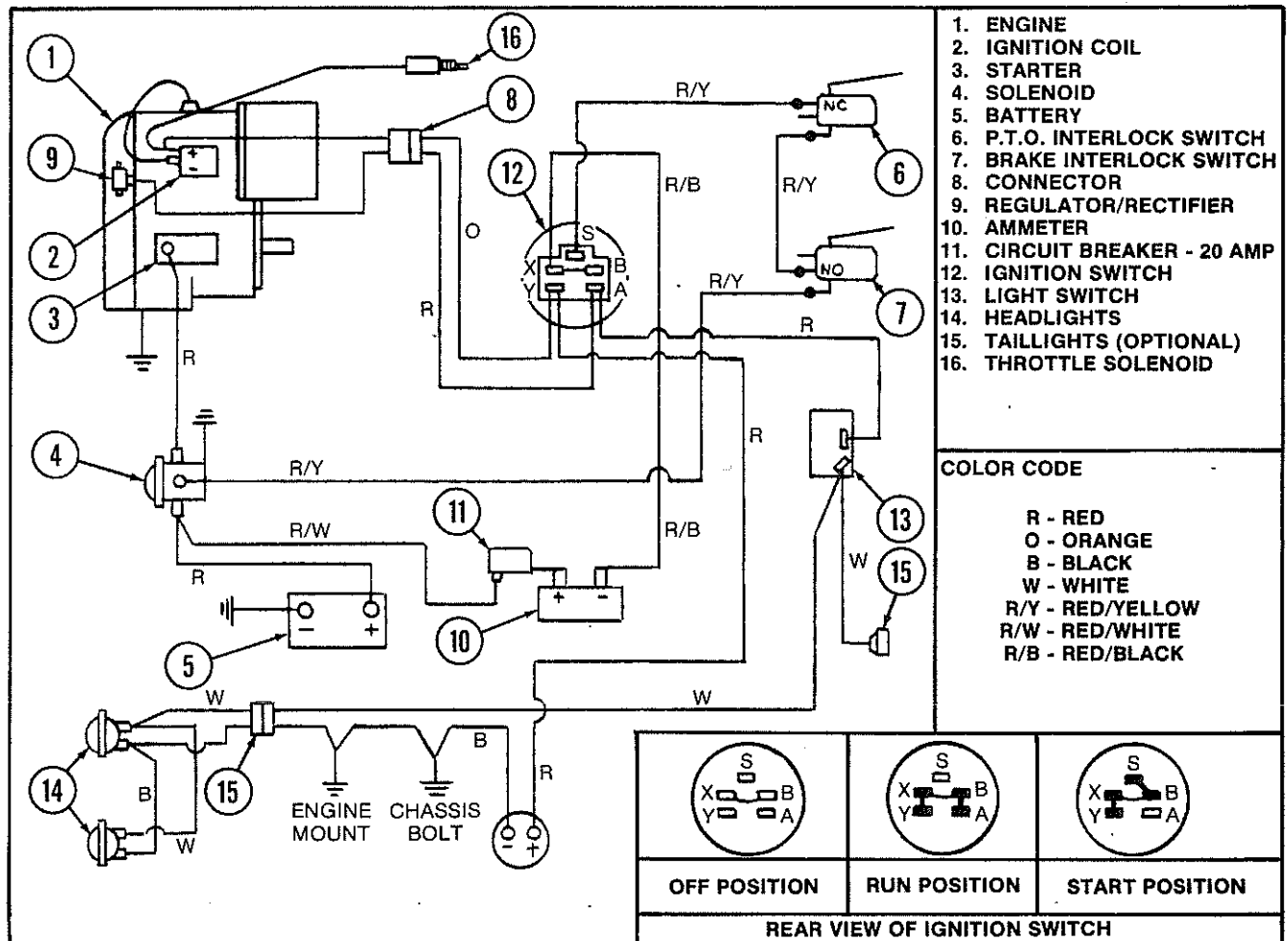


# ELECTRICAL SYSTEM (Continued)

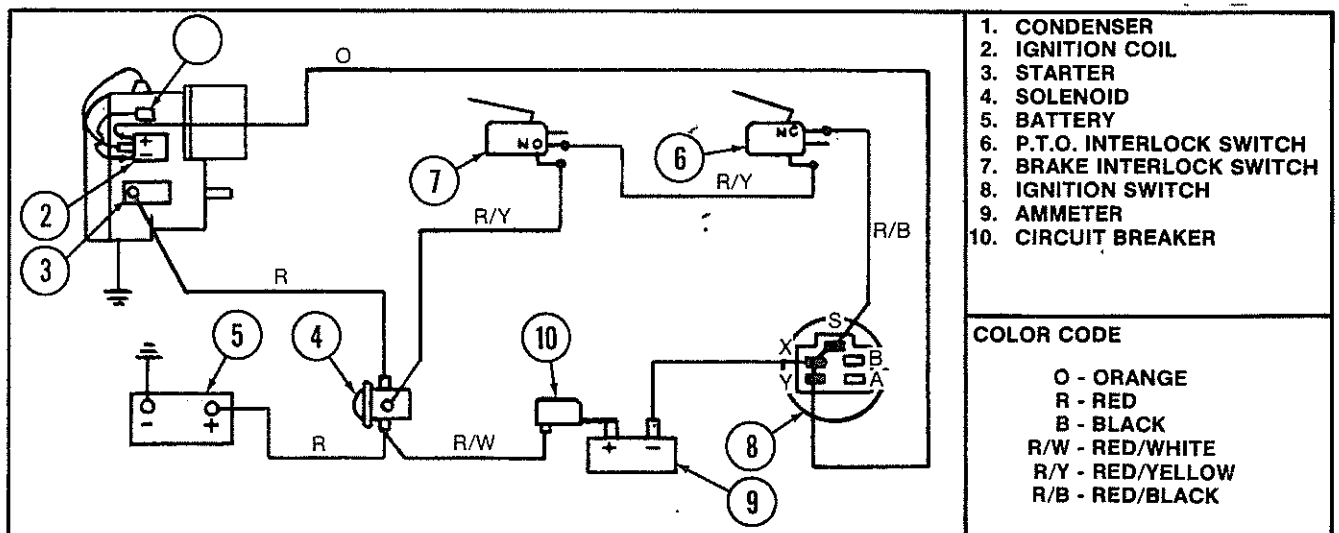
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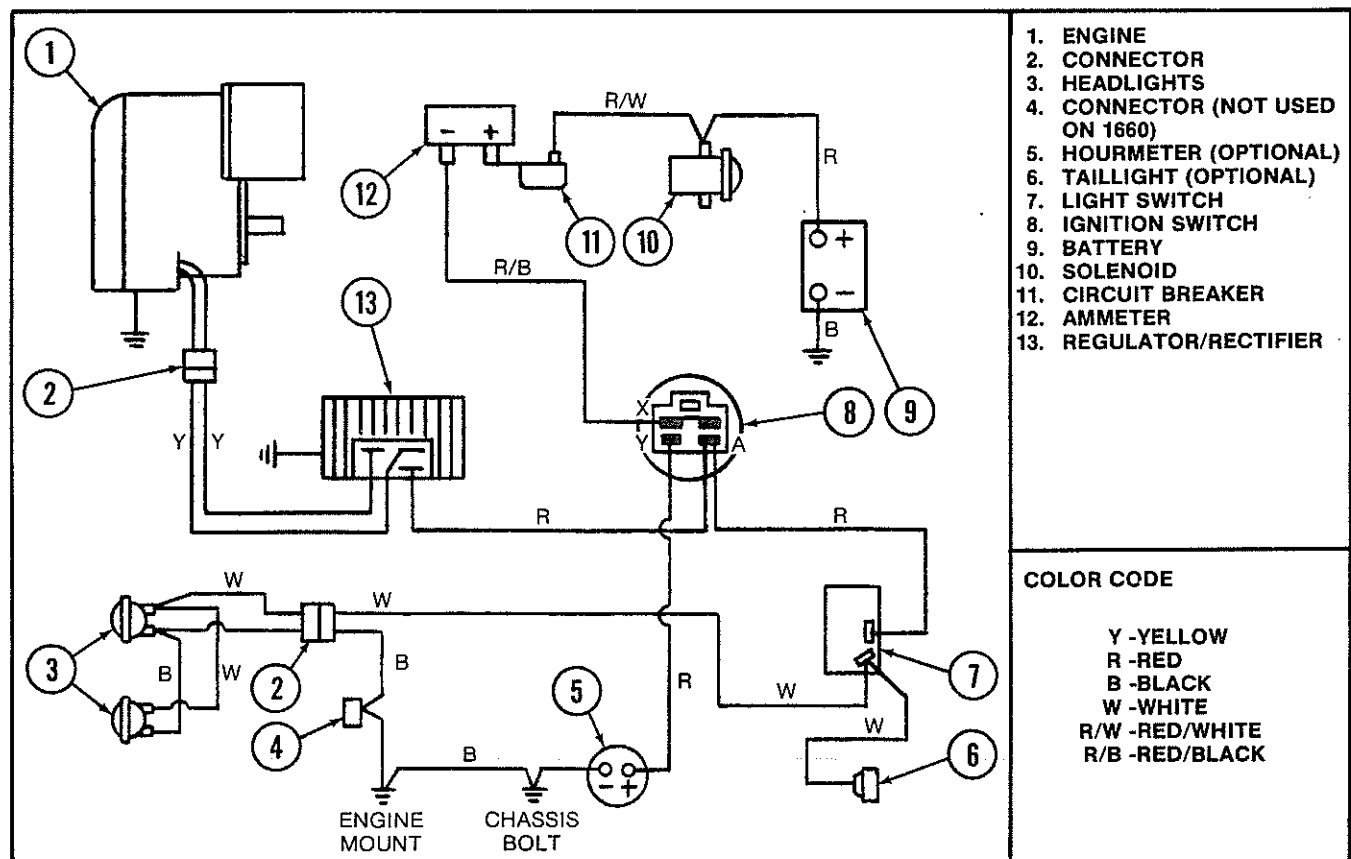
Page 2-5 REV. 12/78

## WIRING DIAGRAM 1660 S/N 0200101 AND LATER

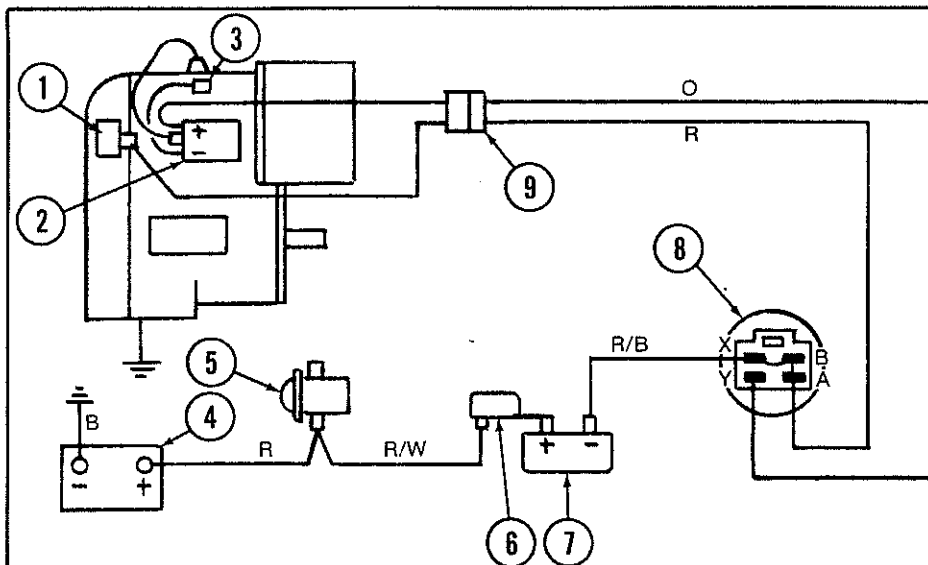


## START-RUN CIRCUIT 1660 S/N 0100101 AND LATER





## CHARGING CIRCUIT 1660 S/N 0200101 AND LATER

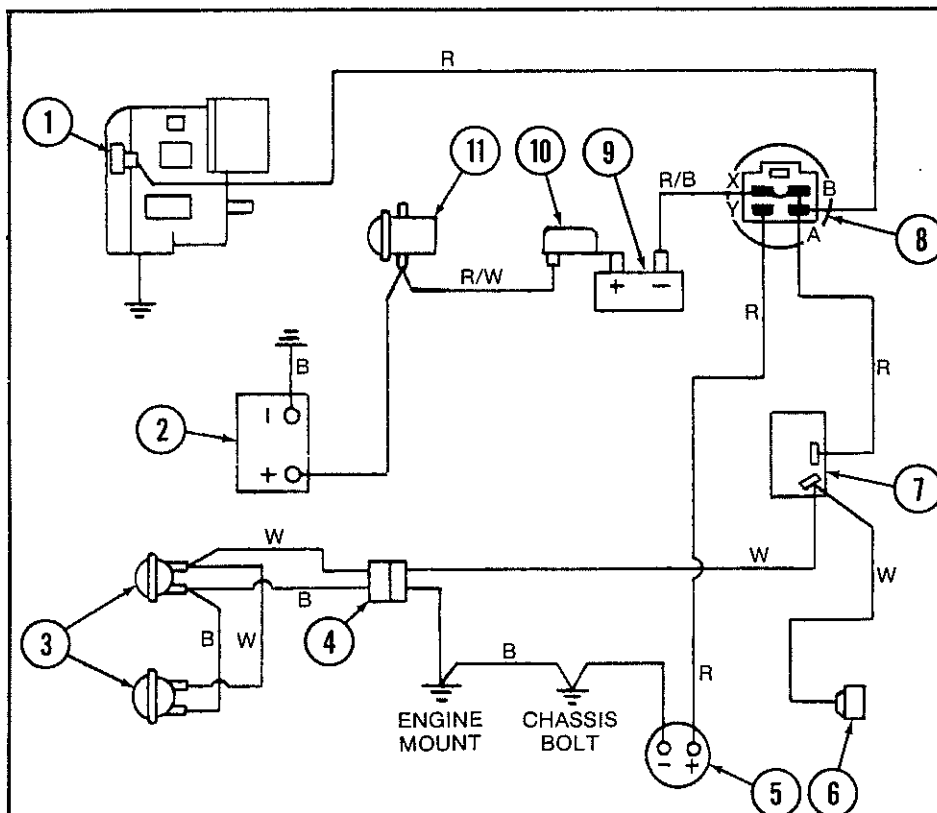


1. RECTIFIER/REGULATOR
2. IGNITION COIL
3. CONDENSOR
4. BATTERY
5. SOLENOID
6. CIRCUIT BREAKER
7. AMMETER
8. IGNITION SWITCH
9. CONNECTOR

### COLOR CODE

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

## LIGHT CIRCUIT 1660 S/N 0200101 AND LATER

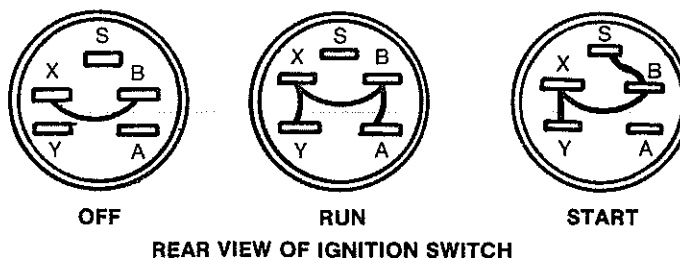


1. RECTIFIER/REGULATOR
2. BATTERY
3. HEADLIGHTS
4. CONNECTOR
5. HOUR METER (OPTIONAL)
6. TAILLIGHT (OPTIONAL)
7. LIGHT SWITCH
8. CIRCUIT BREAKER
9. AMMETER
10. SOLENOID

### COLOR CODE

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



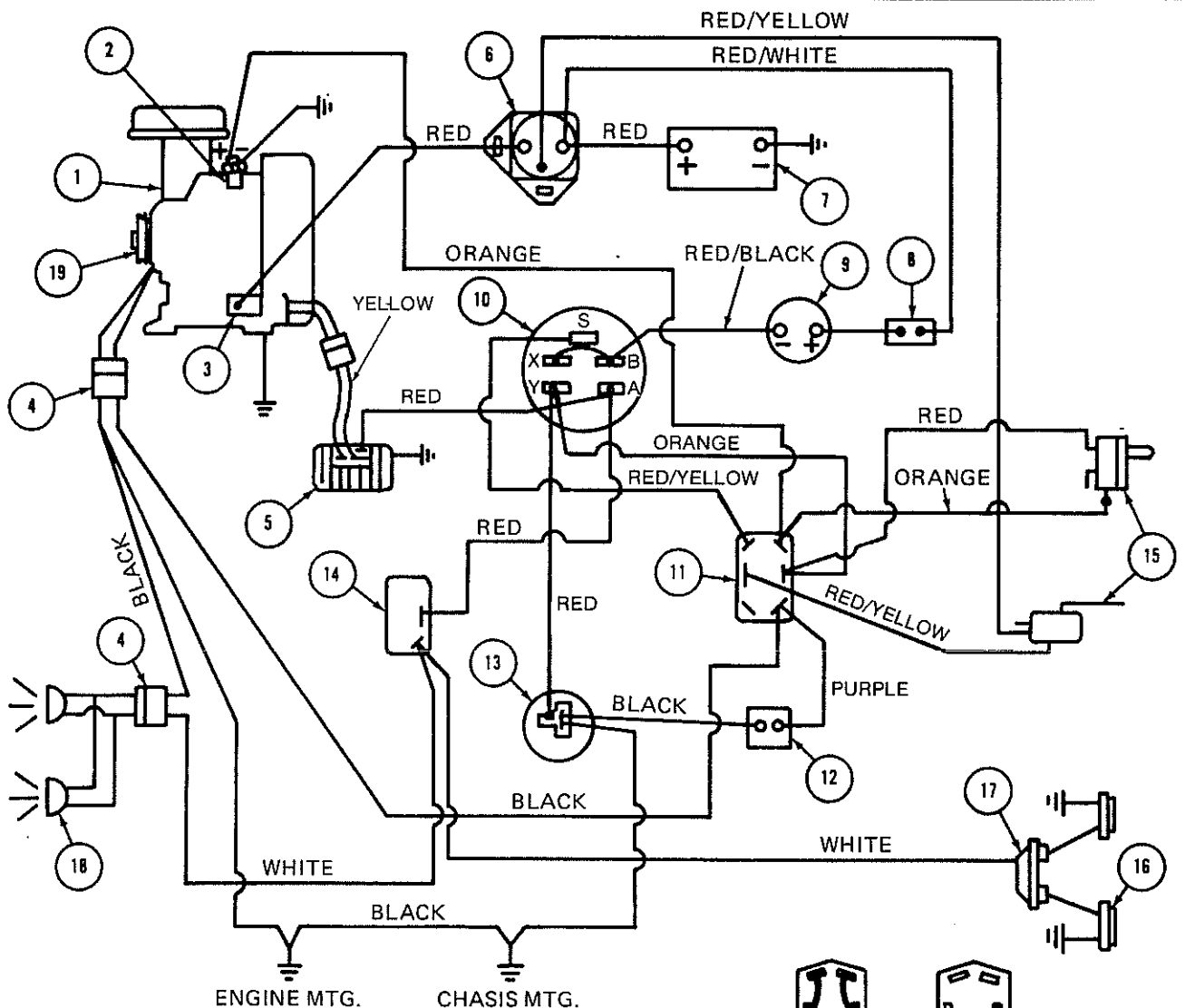


# ELECTRICAL SYSTEM (Continued)

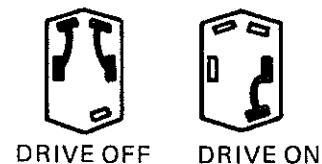
QS, QT & 1900 SERIES

Page 2-9 REV. 12/78

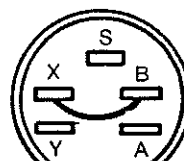
## WIRING DIAGRAM S/N 0500101 THRU 0599999



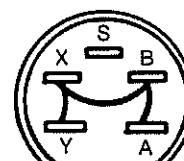
1. ENGINE
2. IGNITION COIL
3. STARTER
4. CONNECTOR
5. REGULATOR/RECTIFIER
6. SOLENOID
7. BATTERY
8. CIRCUIT BREAKER - 20 AMP
9. AMMETER
10. IGNITION SWITCH
11. ATTACHMENT DRIVE SWITCH
12. P.T.O. INDICATOR LIGHT
13. HOURMETER
14. LIGHT SWITCH
15. INTERLOCK SWITCH
16. TAILLIGHTS
17. CONNECTOR
18. HEADLIGHTS
19. ATTACHMENT DRIVE



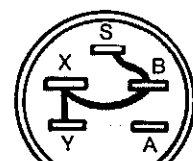
REAR VIEW OF  
ATTACHMENT  
DRIVE SWITCH



OFF



RUN

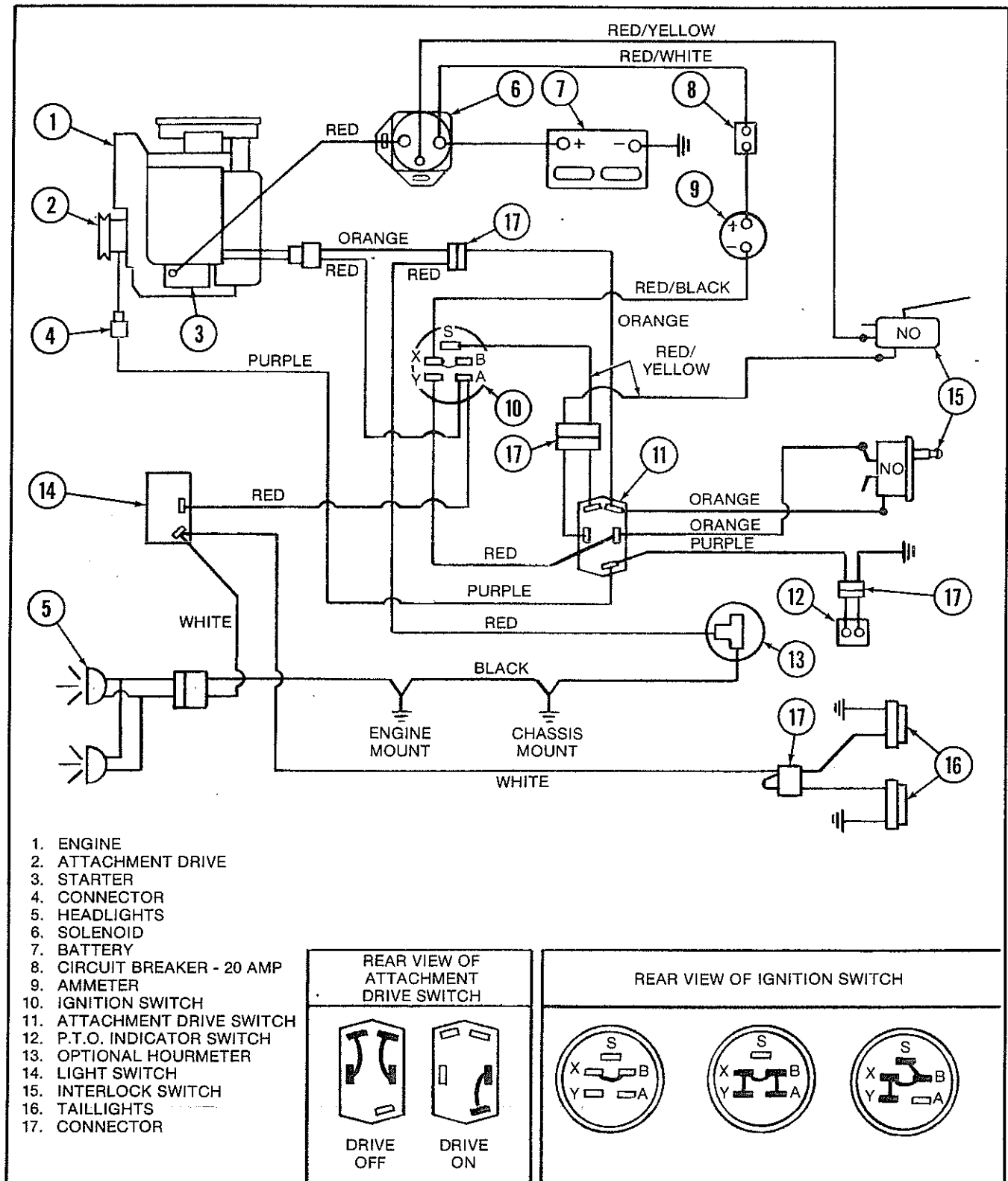


START

REAR VIEW OF IGNITION SWITCH

# ELECTRICAL SYSTEM (Continued)

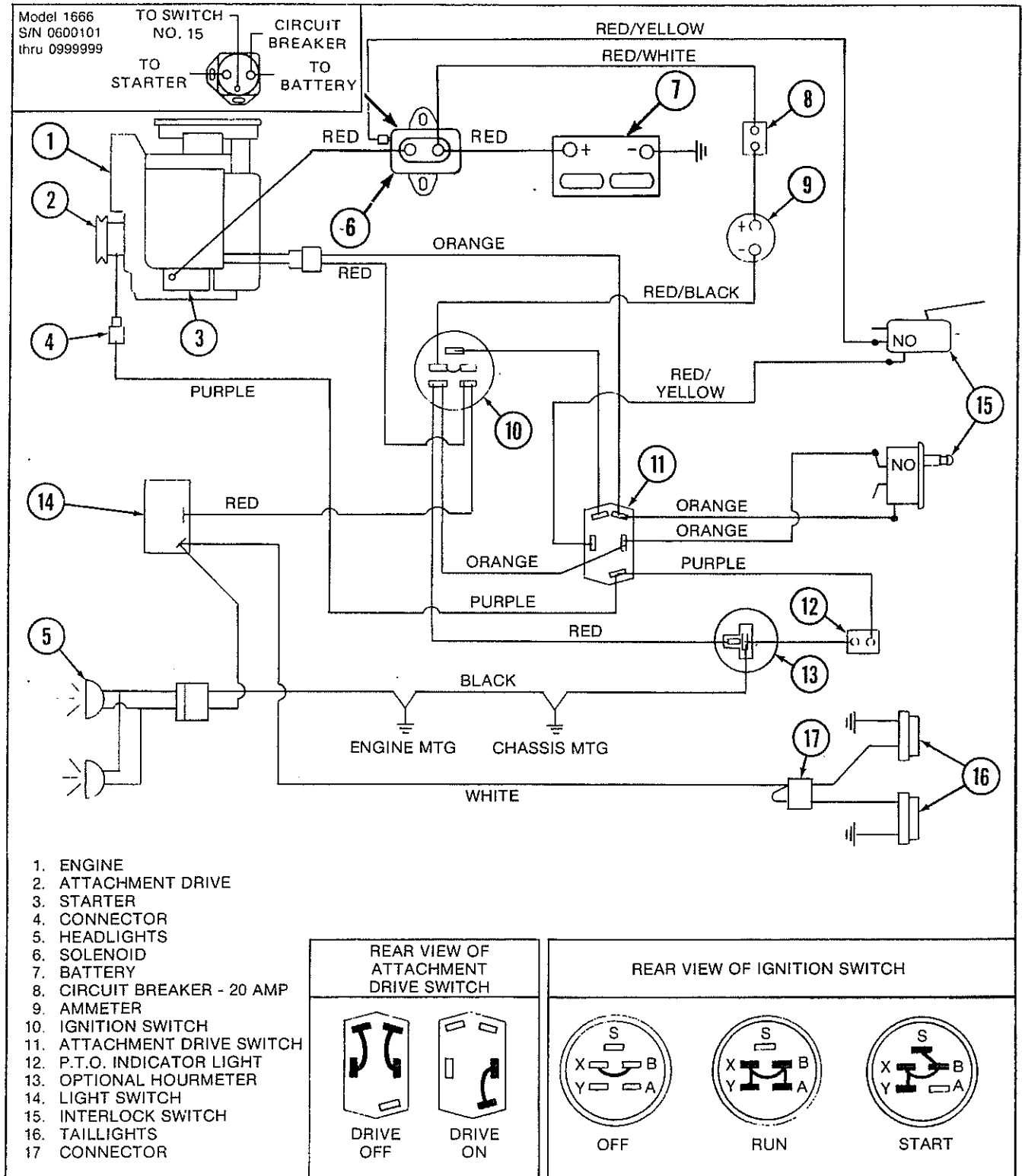
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# ELECTRICAL SYSTEM (Continued)

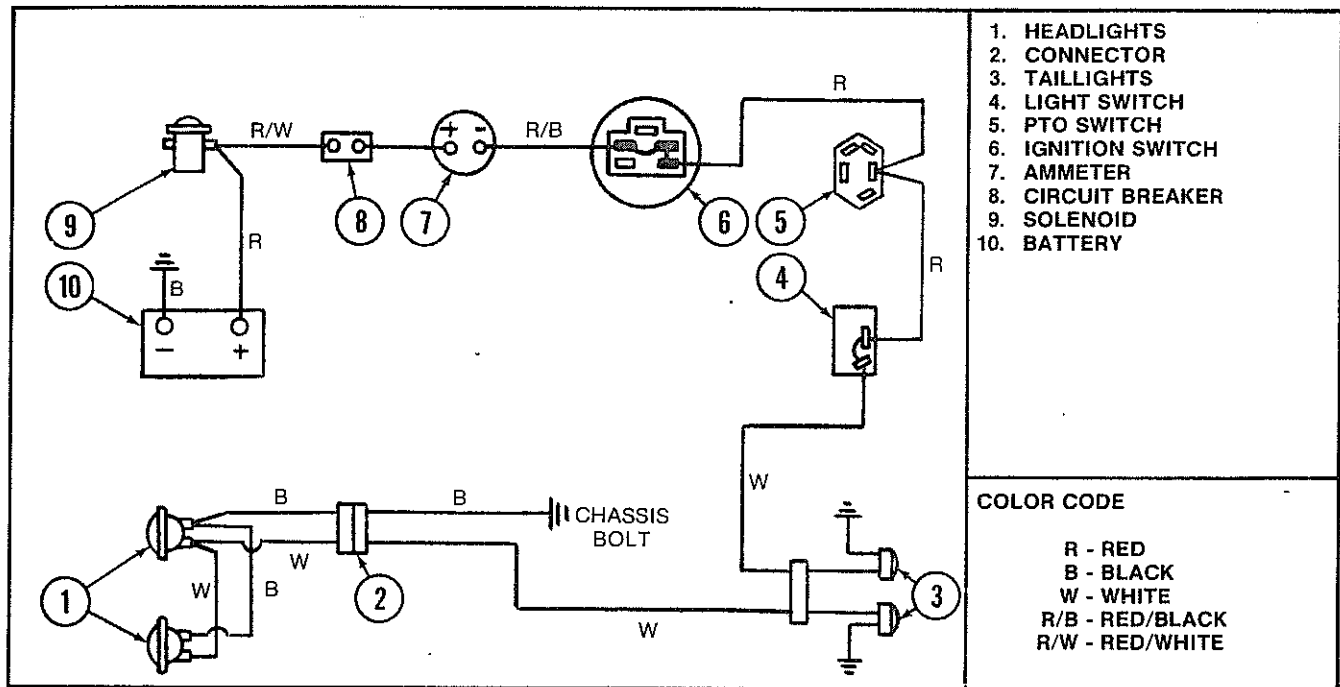
QS, QT & 1900 SERIES  
TRACTORS  
Page 2-11 REV. 4/83

## WIRING DIAGRAM 1666 S/N 0700101 AND LATER 1966 S/N 0100101 AND LATER

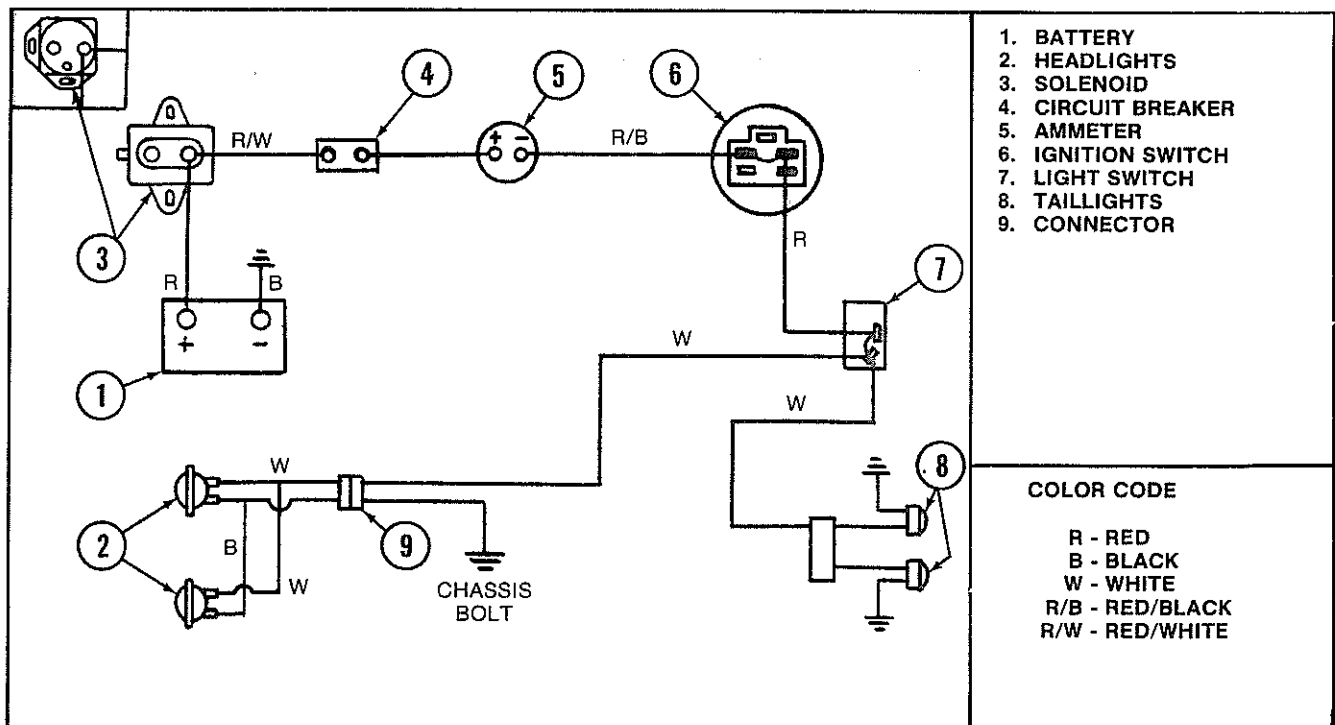


## ELECTRICAL SYSTEM (Continued)

### LIGHT CIRCUIT 1666 S/N 0100101 THRU 0499999



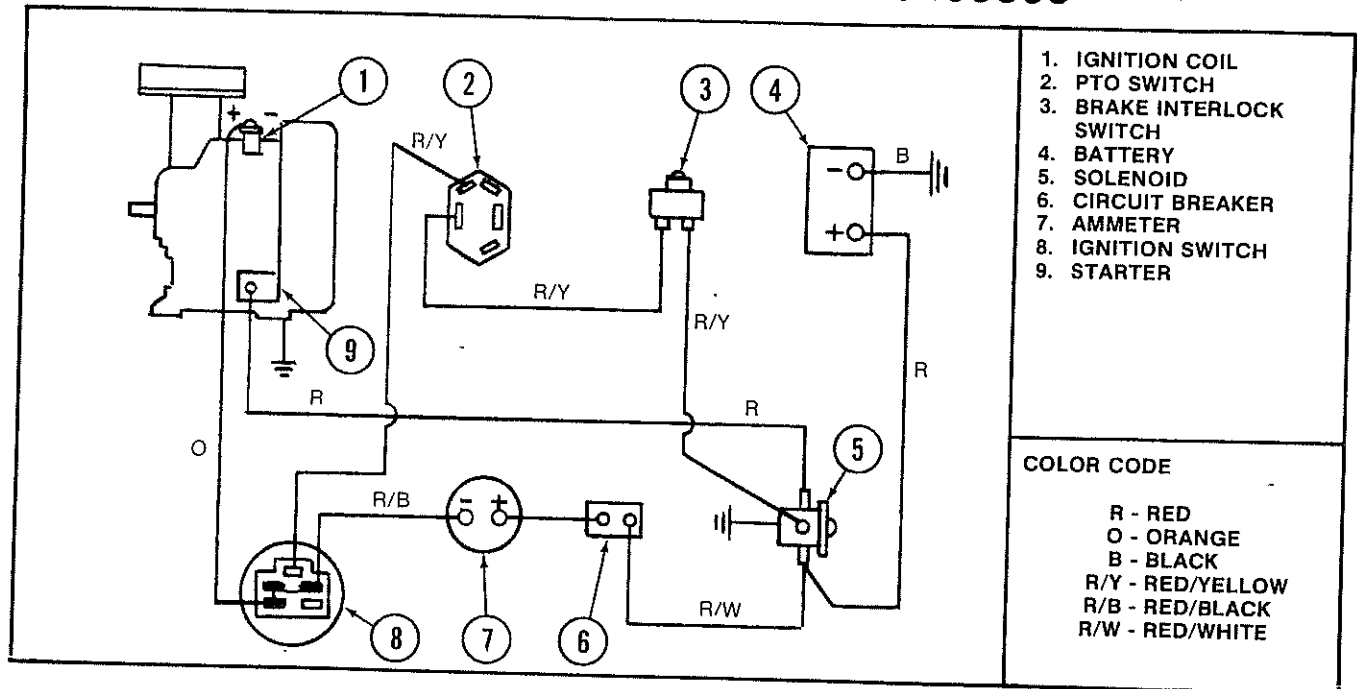
### LIGHT CIRCUIT 1666 S/N 0500101 AND LATER 1966 S/N 0100101 AND LATER



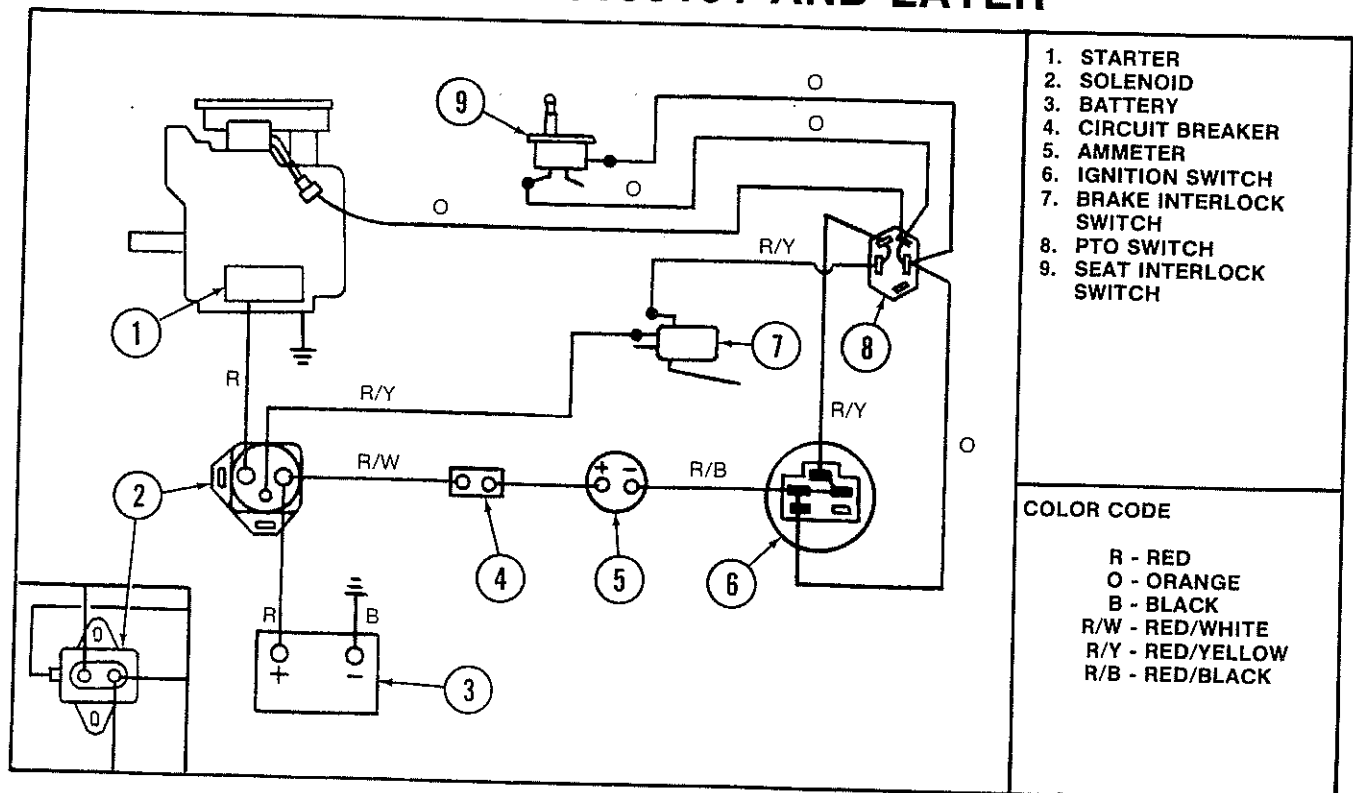
# ELECTRICAL SYSTEM (Continued)

QS, QT & 1900 SERIES  
TRACTORS  
Page 2-13 REV. 4/83

## START-RUN CIRCUIT 1666 S/N 0100101 THRU 0499999

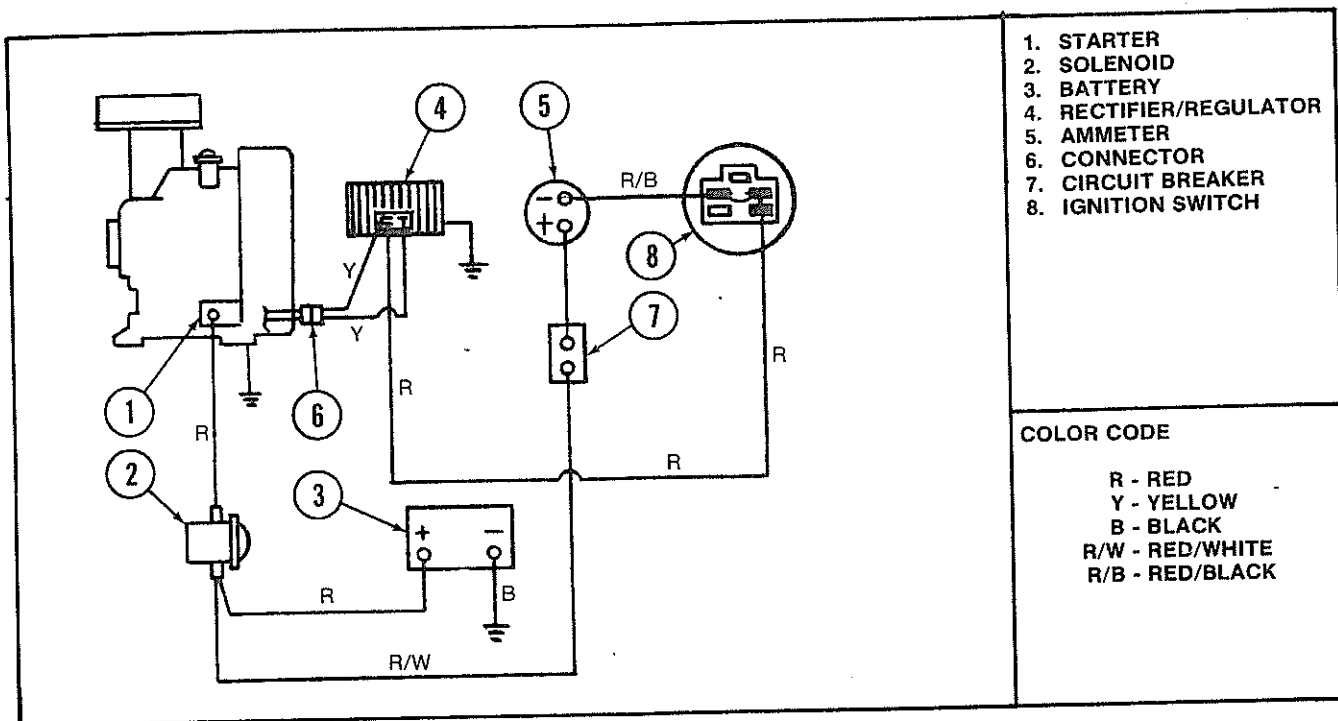


## START-RUN CIRCUIT 1666 S/N 0500101 AND LATER 1966 S/N 0100101 AND LATER

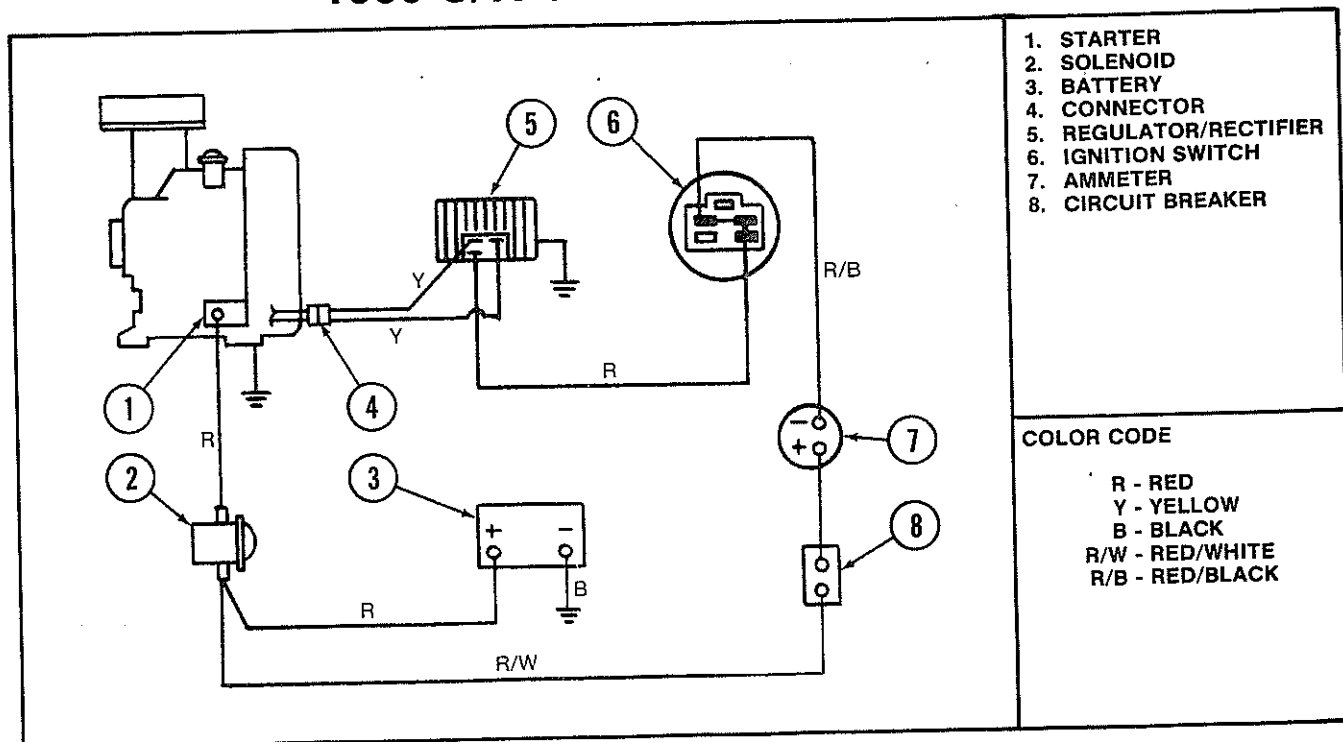


# ELECTRICAL SYSTEM (Continued)

## CHARGING CIRCUIT 1666 S/N 0100101 THRU 0499999



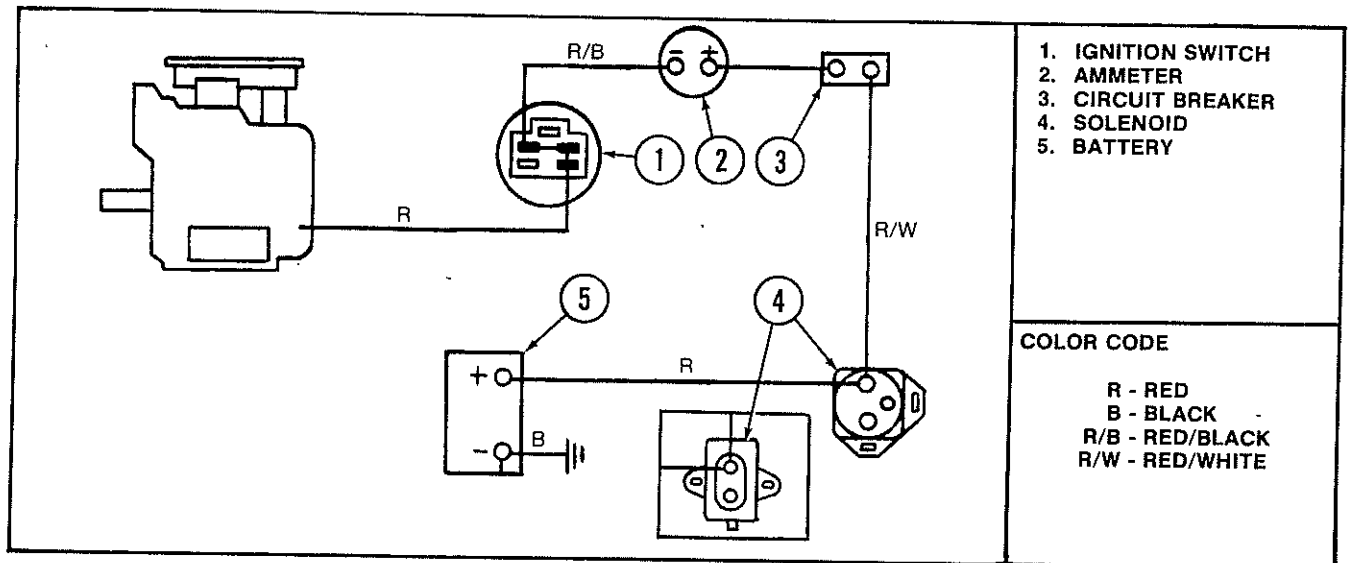
## CHARGING CIRCUIT 1666 S/N 0500101 THRU 0599999



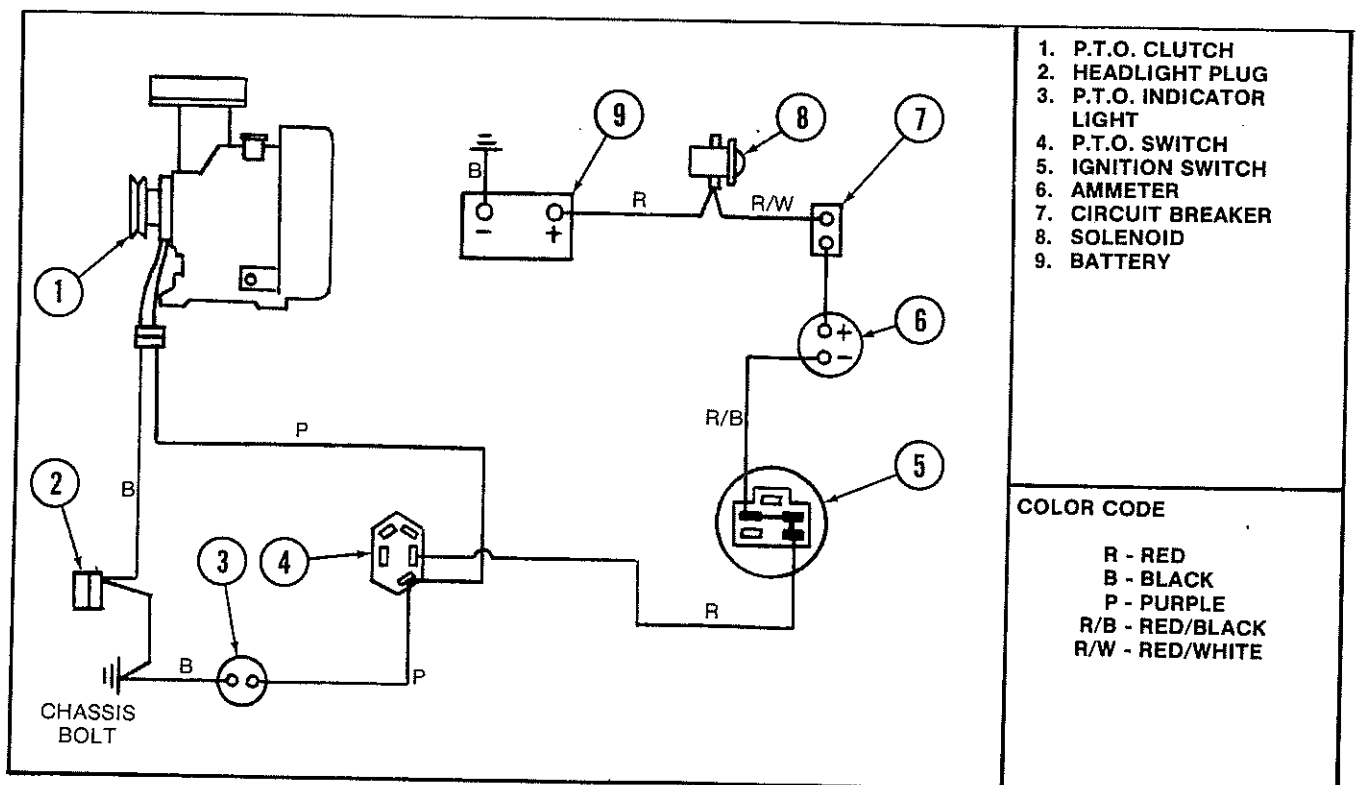
## ELECTRICAL SYSTEM (Continued)

QS, QT & 1900 SERIES  
TRACTORS  
Page 2-15 REV. 4/83

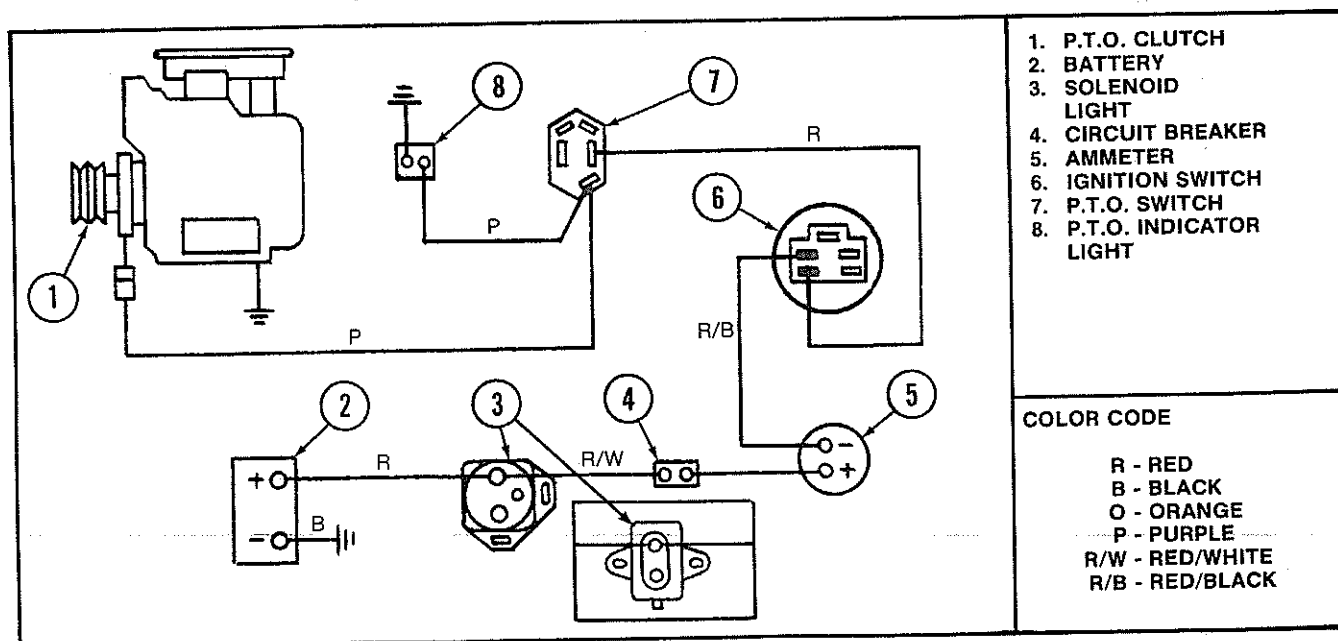
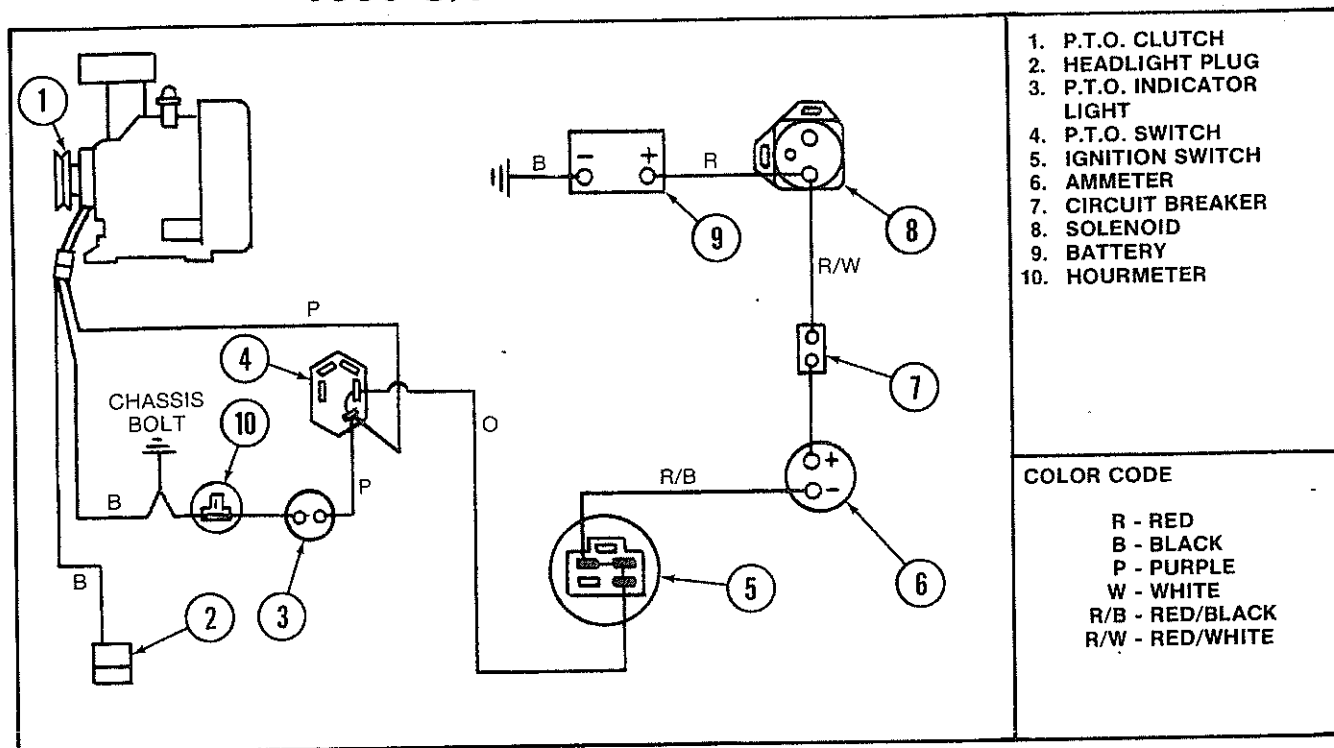
### CHARGING CIRCUIT 1666 S/N 0600101 AND LATER 1966 S/N 0100101 AND LATER



### P.T.O. CLUTCH CIRCUIT 1666 S/N 0100101 THRU 0499999



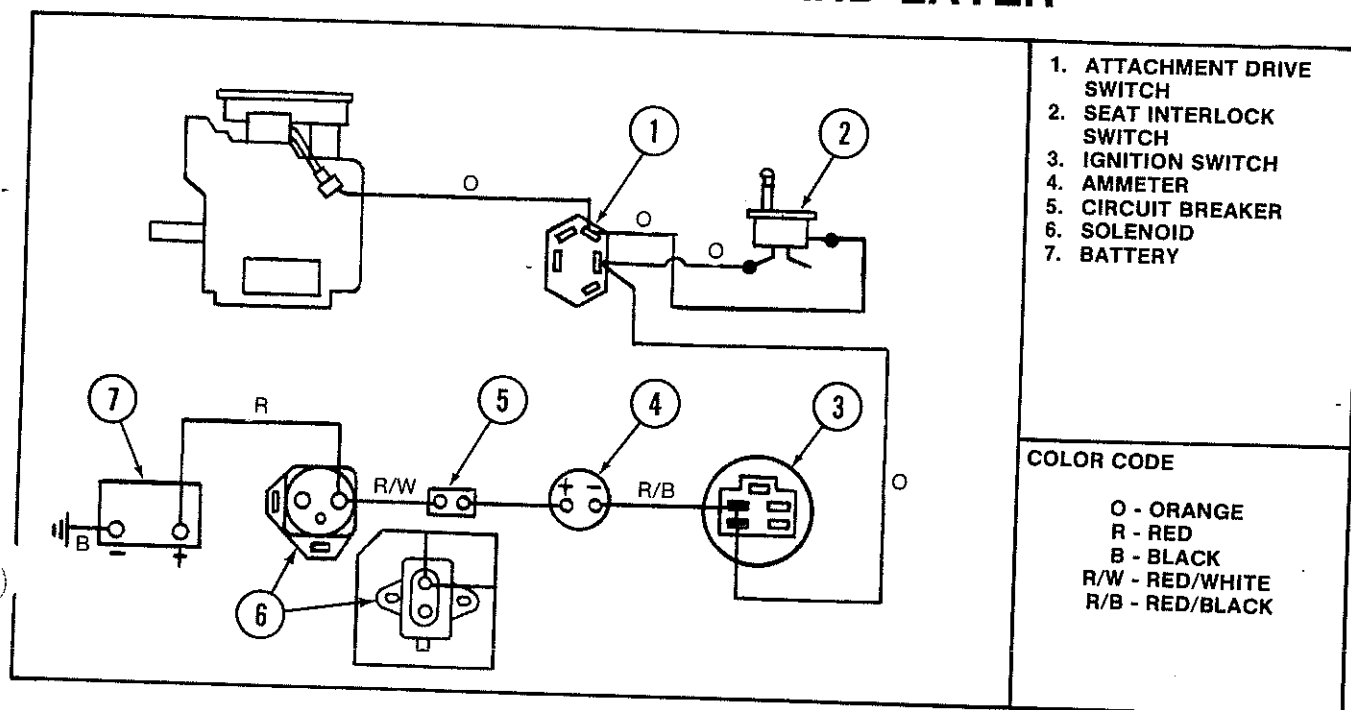




# ELECTRICAL SYSTEM (Continued)

QS, QT & 1900 SERIES  
TRACTORS  
Page 2-17 REV. 4/83

## SEAT SWITCH CIRCUIT 1666 S/N 0500101 AND LATER 1966 S/N 0100101 AND LATER



## TESTING ELECTRICAL SYSTEM

## 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. (26° C).

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 steps 1 through 4. If same results are obtained, replace battery.

## SOLENOID TEST

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

To test the solenoid connect 12 volts between the solenoid case and the small solenoid terminal. **CAUTION:** If battery is the 12 volt power source a spark may ignite battery gases.

When contact is made the plunger should be activated. If test does not activate the plunger, replacement is necessary.

## SWITCH TEST

Before electrical tests of the switches are made, make sure mechanical adjustments of the actuating mechanisms are correct.

## SEAT SWITCH

The seat switch is wired normally open (NO).

To test connect ohm meter as shown in Figure 2-1 and depress plunger. Meter should indicate

zero resistance. At normally closed position the meter should indicate a infinite resistance.

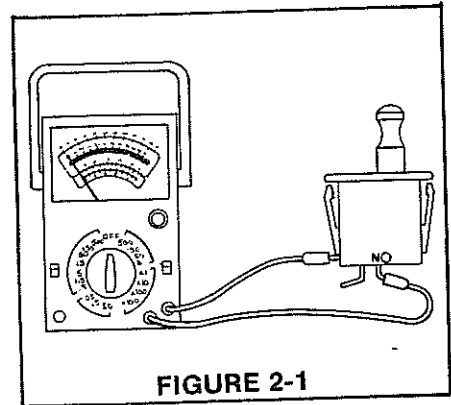


FIGURE 2-1

## BRAKE SWITCH (Figure 2-15)

The brake switch is wired normally open (NO).

To test switch connect a ohm meter and depress plunger. Meter should indicate zero resistance.

At normally open (NO) position the meter should indicate a infinite reading.

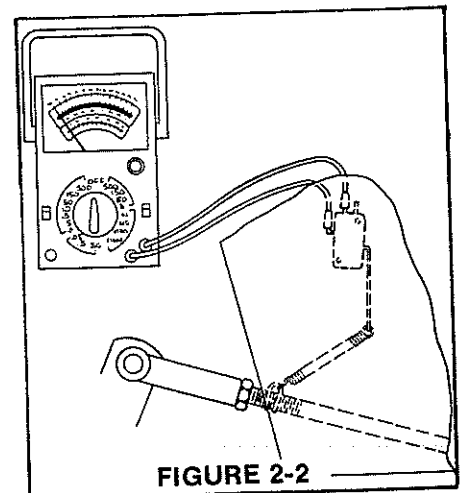


FIGURE 2-2

## TESTING ELECTRICAL SYSTEM

### ATTACHMENT DRIVE SWITCH (1966 & 1666 only)

When switch is in down position check continuity between the middle terminal and top terminal on same side. (Check both sides) See Figure 2-3. Resistance should be zero.

When switch is in top position check continuity between the right middle terminal and right bottom terminal. See Figure 2-3. Resistance should be zero.

### TESTING IGNITION SWITCH

Test the ignition switch for proper internal connections using an ohm meter or continuity light. Terminals should be closed only in positions indicated in Figure 2-4.

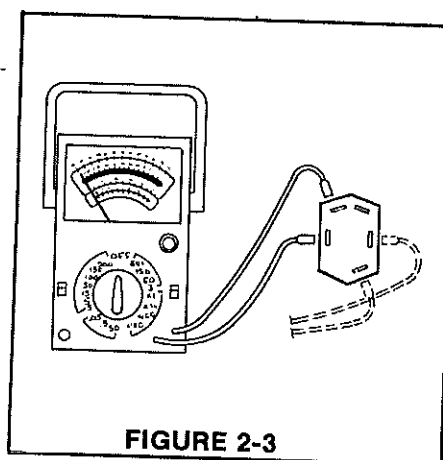
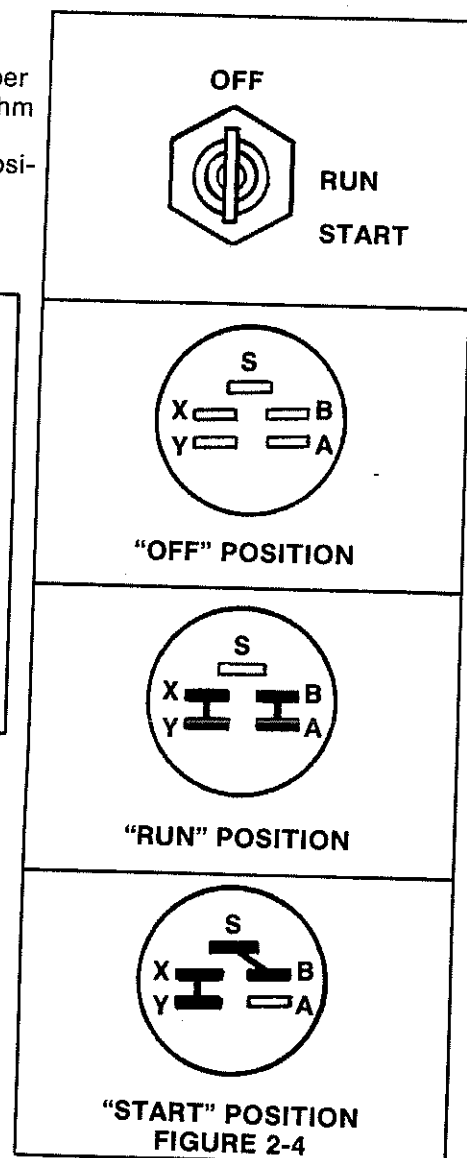


FIGURE 2-3



## GROUP III: DRIVE TRAIN

QS, QT & 1900 SERIES

Page 3-1 REV. 12/78

### TROUBLE SHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	REMEDY
Unit will not operate in either forward or reverse	<ol style="list-style-type: none"><li>1. Free wheeling valve open (Sundstrand Hydro models)</li><li>2. System low on oil</li><li>3. Plugged oil filter</li><li>4. Faulty control linkage</li><li>5. Hydro input shaft not turning</li><li>6. Hydro unit not functioning</li></ol>	<ol style="list-style-type: none"><li>1. Close valve</li><li>2. Refill to proper level</li><li>3. Replace filter</li><li>4. Check linkage, correct problem</li><li>5. Check input shaft key, replace if necessary</li><li>6. Repair or replace hydro</li></ol>
Unit will operate in one direction only	<ol style="list-style-type: none"><li>1. Faulty control linkage</li><li>2. One check valve stuck open</li></ol>	<ol style="list-style-type: none"><li>1. Check linkage, correct problem</li><li>2. Remove and inspect, clean or replace if needed</li></ol>
Loss of power	<ol style="list-style-type: none"><li>1. Low on oil</li><li>2. Free wheeling valve partially open (Sundstrand Hydro models)</li><li>3. Filter or suction line clogged</li><li>4. Worn linkage</li><li>5. Air in system</li><li>6. Engine lugs down</li></ol>	<ol style="list-style-type: none"><li>1. Check and add as necessary</li><li>2. Close valve</li><li>3. Replace filter, clean and refill system</li><li>4. Replace or adjust</li><li>5. Refill and check for leaks</li><li>6. Check engine for proper power level</li></ol>
Unit operating hot	<ol style="list-style-type: none"><li>1. Oil level low</li><li>2. Dirt on transmission</li><li>3. Excessive load or high drawbar loading</li><li>4. Fan not turning</li><li>5. Partially plugged filter</li><li>6. Internal damage to hydro</li></ol>	<ol style="list-style-type: none"><li>1. Check for leaks and refill to proper level</li><li>2. Clean external surface</li><li>3. Reduce load or drawbar loading</li><li>4. Check fan for proper operation</li><li>5. Replace filter and oil</li><li>6. Repair or replace hydro</li></ol>

3

## HYDROSTATIC IDENTIFICATION & REPAIR

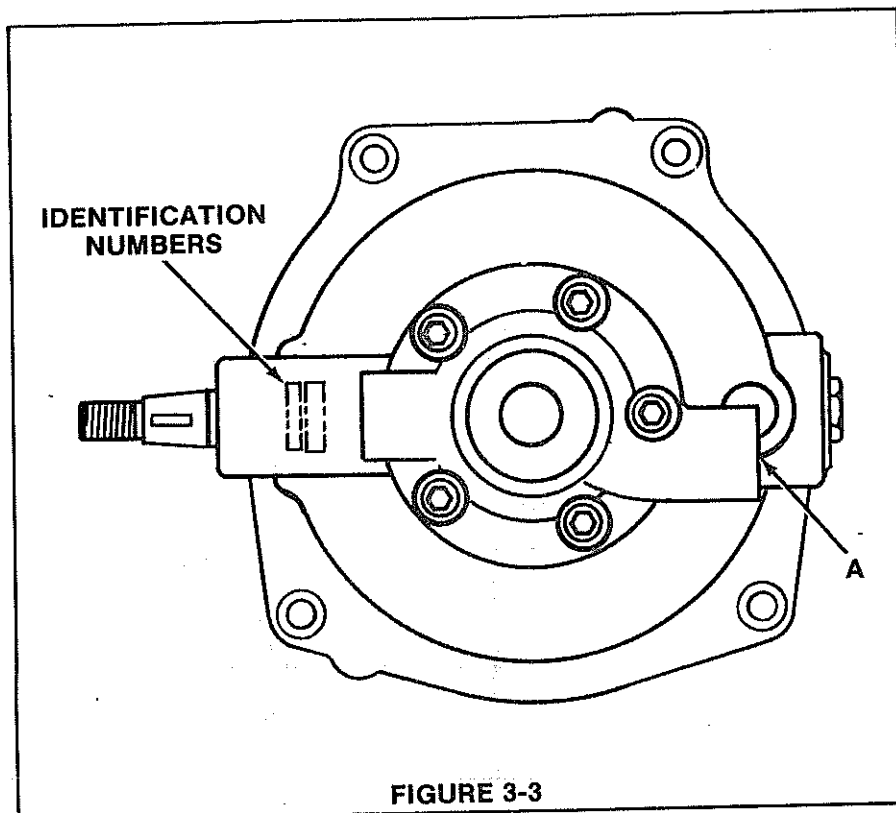
**IMPORTANT:** A Left Hand drive hydrostatic is used in the "Q" series tractor.

### EATON

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

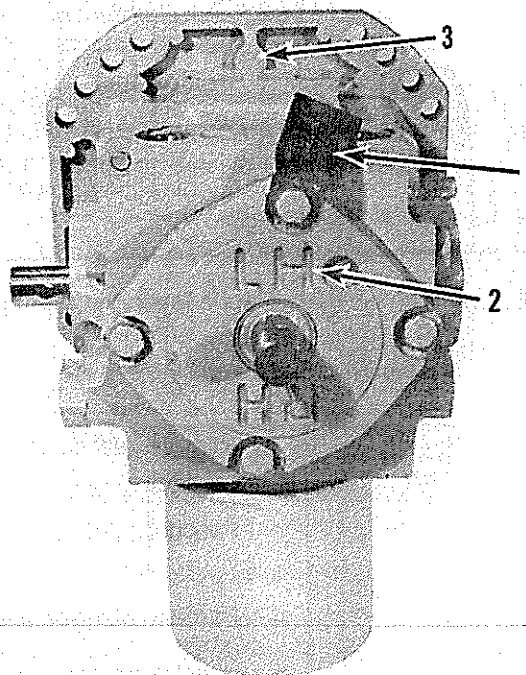
### REPAIR

If the hydrostatic transmission is in need of repair, refer to the Eaton Service & Repair Manual. This manual is available at the factory.



### SUNDSTRAND

1. Model Number is located on the hydrostatic identification tag.
2. Charge pump housing should have the L.H. (Left Hand) casting marking up and above the input shaft.
3. Motor housing must have the round casting mark up.



## GROUP III: DRIVE TRAIN

QS, QT & 1900 SERIES

Page 3-1 REV. 12/78

### TROUBLE SHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	REMEDY
Unit will not operate in either forward or reverse	<ol style="list-style-type: none"><li>1. Free wheeling valve open (Sundstrand Hydro models)</li><li>2. System low on oil</li><li>3. Plugged oil filter</li><li>4. Faulty control linkage</li><li>5. Hydro input shaft not turning</li><li>6. Hydro unit not functioning</li></ol>	<ol style="list-style-type: none"><li>1. Close valve</li><li>2. Refill to proper level</li><li>3. Replace filter</li><li>4. Check linkage, correct problem</li><li>5. Check input shaft key, replace if necessary</li><li>6. Repair or replace hydro</li></ol>
Unit will operate in one direction only	<ol style="list-style-type: none"><li>1. Faulty control linkage</li><li>2. One check valve stuck open</li></ol>	<ol style="list-style-type: none"><li>1. Check linkage, correct problem</li><li>2. Remove and inspect, clean or replace if needed</li></ol>
Loss of power	<ol style="list-style-type: none"><li>1. Low on oil</li><li>2. Free wheeling valve partially open (Sundstrand Hydro models)</li><li>3. Filter or suction line clogged</li><li>4. Worn linkage</li><li>5. Air in system</li><li>6. Engine lugs down</li></ol>	<ol style="list-style-type: none"><li>1. Check and add as necessary</li><li>2. Close valve</li><li>3. Replace filter, clean and refill system</li><li>4. Replace or adjust</li><li>5. Refill and check for leaks</li><li>6. Check engine for proper power level</li></ol>
Unit operating hot	<ol style="list-style-type: none"><li>1. Oil level low</li><li>2. Dirt on transmission</li><li>3. Excessive load or high drawbar loading</li><li>4. Fan not turning</li><li>5. Partially plugged filter</li><li>6. Internal damage to hydro</li></ol>	<ol style="list-style-type: none"><li>1. Check for leaks and refill to proper level</li><li>2. Clean external surface</li><li>3. Reduce load or drawbar loading</li><li>4. Check fan for proper operation</li><li>5. Replace filter and oil</li><li>6. Repair or replace hydro</li></ol>

3

## PRINCIPLE OF HYDROSTATIC OPERATION

### EATON

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, 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.

### SUNDSTRAND

Engine power is transmitted to the pump input shaft of the transmission by the tractor drive shaft. Rotation of the input shaft causes the main pump block and the charge pump to turn, thus initiating the power transmitting function. Oil from the reservoir is drawn by the charge pump, through the inlet filter, and forced into the low pressure line by way of the low pressure check valves. Oil introduced into the low pressure line by the charge pump fills the area in back of the pistons in the pump section. When the variable swashplate is in the vertical or neutral position the pistons do not move in or out resulting in no oil flow to the pistons in the motor section. Thus the tractor will not move. By tilting the variable swashplate the pistons are forced in and out of the cylinder block, as they rotate across the angled swashplate forcing the oil from the cylinder block under high pressure. The further the swashplate is tilted the longer the stroke of the pistons, causing a greater volume of oil being pumped to the motor section, thus increasing the speed of the tractor. At the bottom of their stroke, the pistons pass again to the low pressure side of the valving plate

and are refilled by the charge pump and oil returning from the motor through the low pressure line. The high pressure oil travels through internal passages to the inlet side of the piston motor. In the motor section, high pressure oil acting on the back of the piston forces the piston "down the stationary tilted swashplate causing the cylinder block to rotate and turn the output shaft." When the variable swashplate is tilted in the opposite position, the pressures are reversed and the motor cylinder block will rotate in the opposite direction, thus reversing the direction of the tractor.

The acceleration valves are placed in the circuit to limit vehicle acceleration to a safe rate. With the control lever in neutral, oil is under low pressure throughout the circuit. When the control lever is advanced rapidly from the neutral to the forward position, the circuit pressure increases and the forward acceleration valve bleeds some of the high pressure oil to the low pressure side of the circuit thus limiting vehicle acceleration. As the vehicle continues to accelerate at the safe rate, high pressure oil leaking past the

acceleration valve body forces the valve down against its seat, stopping the bleeding of oil to the low pressure side. The acceleration valve will remain in this position as long as the control lever position is unchanged. When the control lever is moved into reverse position, the reverse acceleration valve performs in the same way.

The charge pump relief valve is a simple spring loaded valve. The function of this valve is to regulate the supply of low pressure oil to the pistons in the pump section. The excess charge oil is bypassed by this valve to the implement circuit.

When implement hydraulic cylinders are actuated, the pressure supplied by the charge pump is limited by the implement relief valve. The reason for this is to permit the charge pump to supply high pressures for intermittent periods to permit sufficient pressures for implement cylinder actuation. When the implement relief valve opens, the oil is by-passed to the case and pumped into the trans-axle.



## TRANSAXLE REMOVAL

### EATON HYDRO MODELS

MODEL 1666 SHOWN

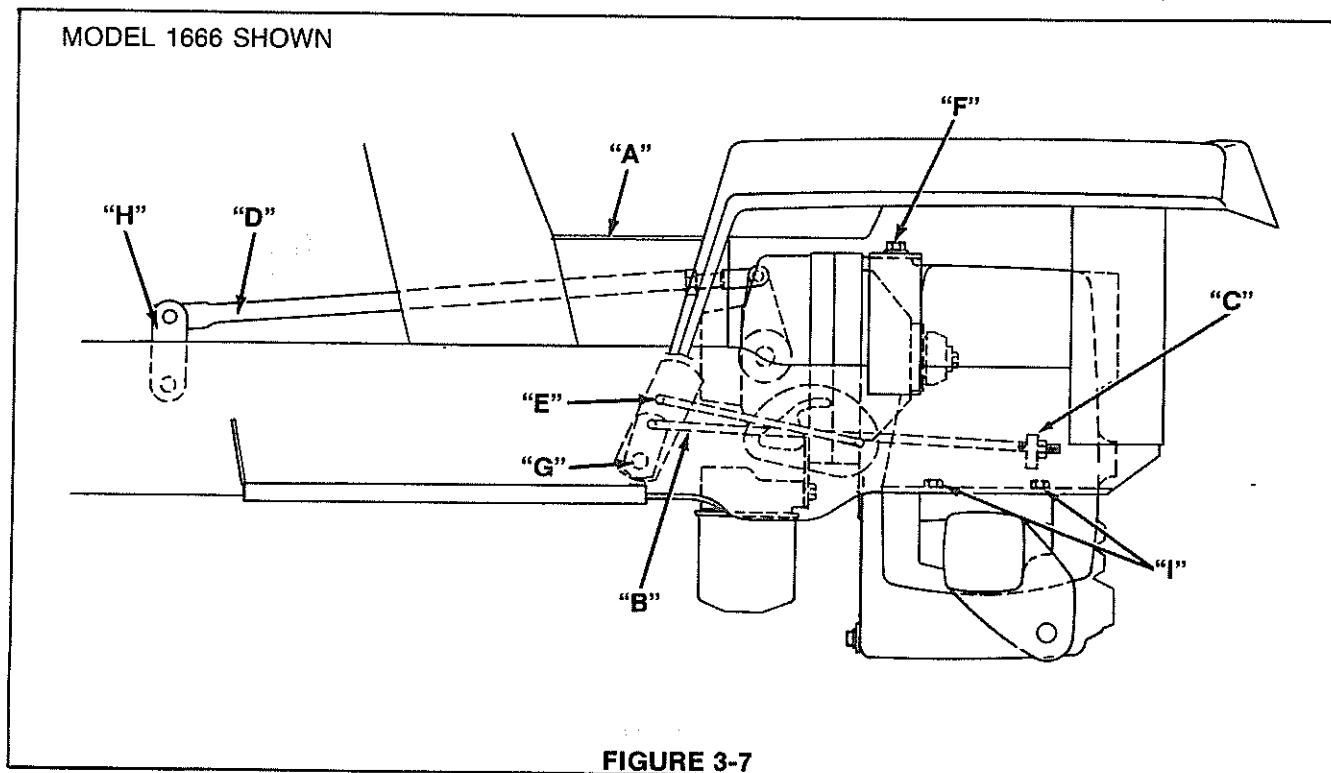


FIGURE 3-7

1. Remove seat and fender assemblies: Be careful to disconnect the seat switch wires before removing.
2. Remove tunnel (A) Figure 3-7.
3. If transaxle is to be worked on, drain fluid and dispose of.
4. Block tractor at midframe.
5. Disconnect two brake arms (B) from brake cross shaft.
6. Remove right hand and left hand brake arm extensions (C) (2 bolts each).
7. Locate hydraulic line between hydro charge pump and lift control valve and disconnect at hydro.
8. Disconnect oil line between control valve and oil filter manifold at manifold.
9. Remove cotter pin and washer and disassemble control rod (D) from the foot pedal shaft.
10. Disconnect rod (E) from lock plate to brake cross shaft at cross shaft.
11. Remove the four screws securing the transaxle to the frame.
12. Remove the two top mounting screws (F).
13. Place one foot on the rear hitch or use a bar in rear hitch hole to balance the transaxle while removing.
14. Slowly roll the complete transaxle and hydro back and out of the frame.
15. After the transaxle assembly has cleared the frame, tip the transaxle backward to rest on a 6" block.

## TRANSAXLE REMOVAL

### SUNDSTRAND HYDRO MODELS

Remove Seat and fender assembly.

Drain transaxle fluid and discard.

Block tractor securely at mid-frame.

Temporarily, block up under filter until all subsequent removal steps have been performed.

Remove Right and Left brake rod adjusting nuts.

Remove Right and Left brake arm extensions (2 bolts each).

Uncouple both lift system fluid lines (temporarily tie up to steering wheel).

Remove hydro control rod clevis pin at travel pedal shaft arm.

Remove cotter pin and disconnect quadrant control link at brake cross shaft.

Remove all 4 (axle to mainframe) mounting capscrews.

Place one foot on rear implement hitch (or use 3/4" bar in rear hitch hole) to balance transaxle while removing the 2 top front bracket screws.

Slowly roll complete transaxle and hydro assembly back and out of frame. **NOTE:** Driveline will slip off the hydro input shaft. Hold driveline temporarily to avoid damaging fan blades.

After transaxle assembly has cleared frame, TIP transaxle backward to rest on a 6" block.

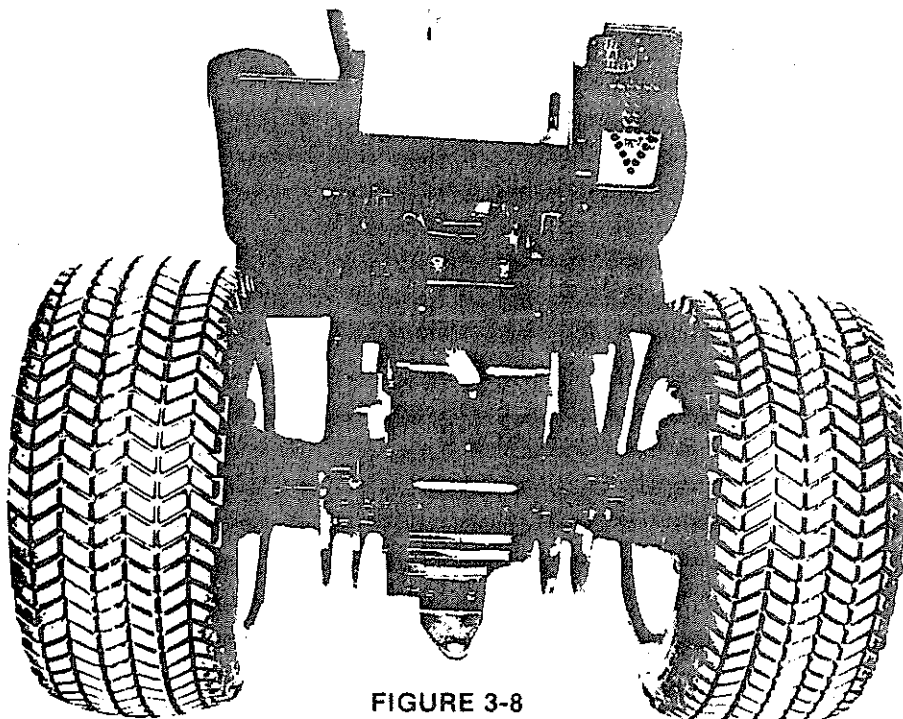


FIGURE 3-8

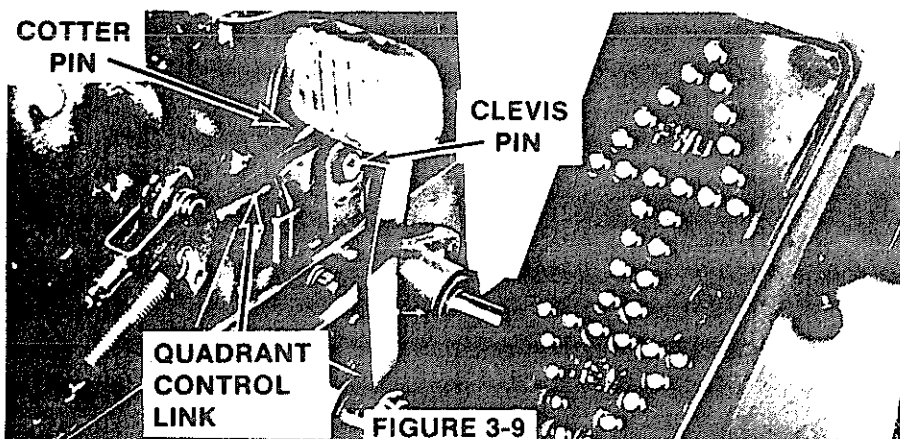


FIGURE 3-9

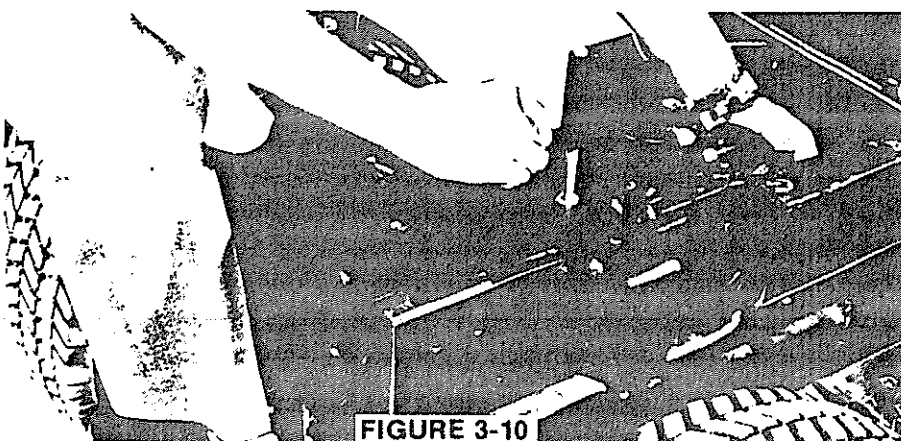


FIGURE 3-10

## HYDROSTATIC REMOVAL

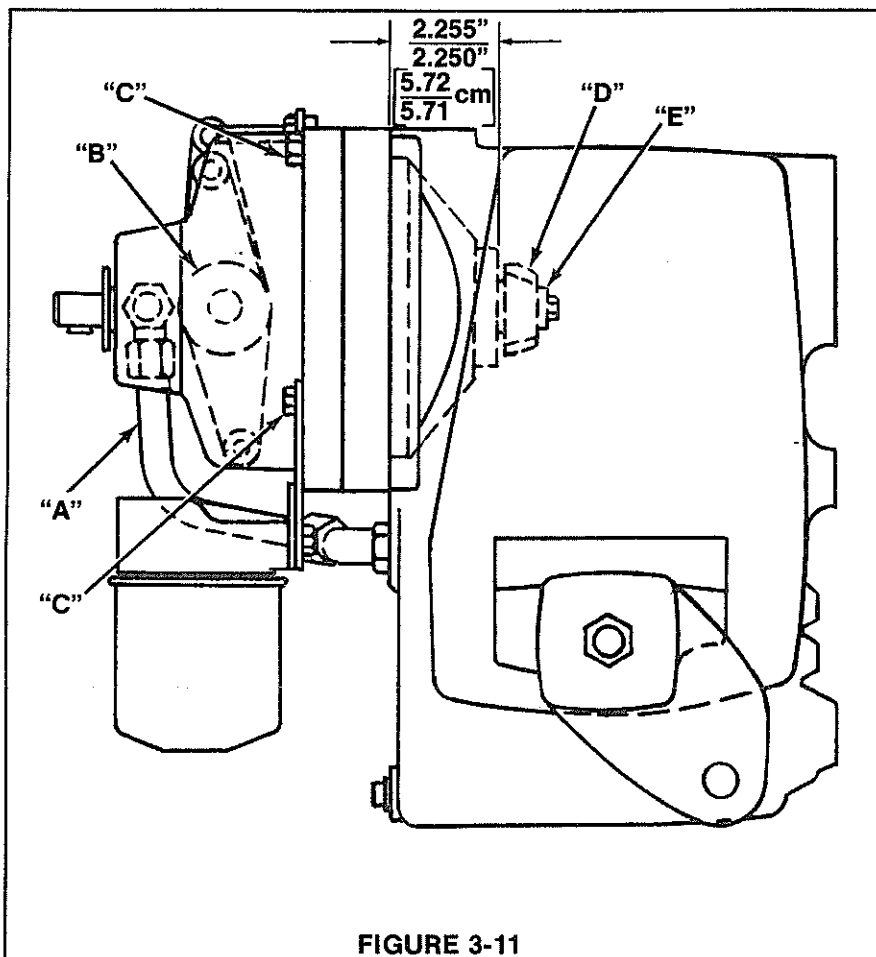
### EATON HYDROSTATIC (FIG. 3-11)

1. Remove the transaxle from the frame. See transaxle removal.
2. Tip the transaxle back and rest on a 6" block.
3. Remove any dirt or grease from hydraulic suction line (A) fittings.
4. Disconnect hydraulic suction line (A) and save.
5. Remove nut and washer on control shaft and slide control arm assembly (B) off and save.

#### NOTE:

**A PULLER MAY HAVE TO BE USED WHEN REMOVING THE CONTROL ARM.**

6. Remove remaining 2 oil filter lines at hydro.
7. Remove the four (4) mounting screws (C) securing the hydro and oil filter.
8. If replacing complete hydro, remove the three hydraulic tube fittings and install them into the new hydrostatic. Do not tighten.
9. If replacing complete hydro, remove bevel gear (D) on output shaft. To disassemble, hold spacer (E) in place when loosening nut. Position bevel gear onto new hydrostatic and fasten. Torque nut to 24 ft. lbs. (32.5 N.m).



**FIGURE 3-11**

### SUNDSTRAND HYDRO

1. Drain fluid from Transaxle.

#### NOTE:

**DO NOT REUSE OLD FLUID.**

2. Loosen set screw and remove bolt holding drive shaft on engine crankshaft. Slide shaft forward until it clears hydro input shaft.

3. Disconnect hydraulic lines (Reference "A" fig. 3-12).

4. Disconnect pick-up tube line (Reference "B" at hydro end).

5. Remove hydro oil filter.

6. Remove bolt holding neutral adjusting rod (Reference "C").

## DRIVE TRAIN (Continued)

### HYDROSTATIC REMOVAL

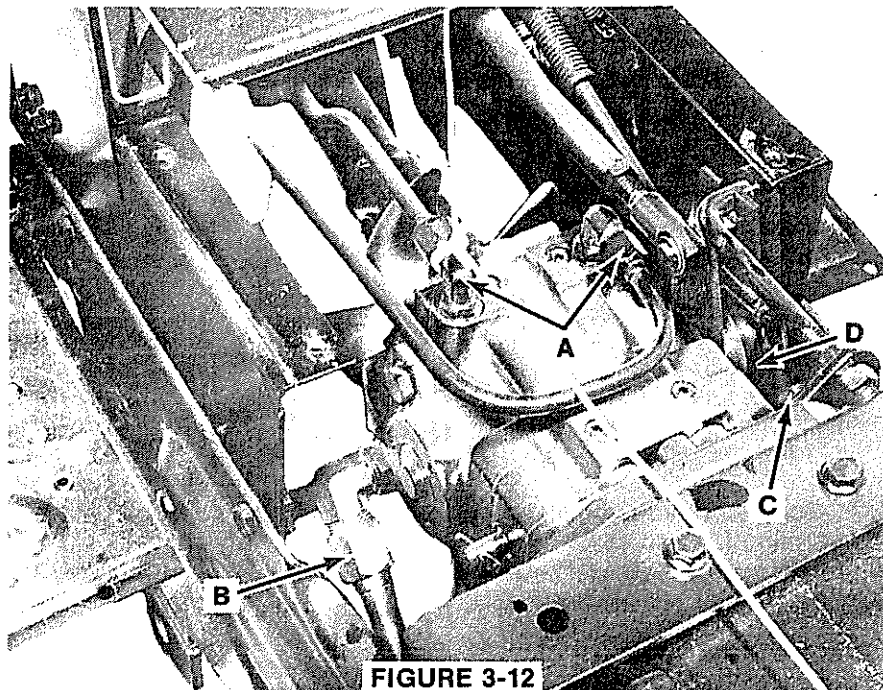
#### SUNDSTRAND HYDRO

1. Drain fluid from Transaxle.

**NOTE:**

**DO NOT REUSE OLD FLUID.**

2. Loosen set screw and remove bolt holding drive shaft on engine crankshaft. Slide shaft forward until it clears hydro input shaft.
3. Disconnect hydraulic lines (Reference "A" fig. 3-12).
4. Disconnect pick-up tube line (Reference "B" at hydro end).
5. Remove hydro oil filter.
6. Remove bolt holding neutral adjusting rod (Reference "C").
7. Drive out roll pin (Reference "D" fig. 3-12) holding linkage to control shaft. Remove linkage as an assembly.
8. Remove the remaining three bolts holding hydro.



**FIGURE 3-12**

**NOTE:**

**HOLD HYDRO WHILE REMOVING LAST BOLT TO PREVENT IT FROM DROPPING. REMOVE HYDRO FROM TRACTOR.**

9. Remove the two oil line fittings and the pickup tube fitting from old hydro.

10. Remove roll pin from free wheeling valve if replacing hydro.

### HYDROSTATIC REPAIR

#### REPAIR

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

#### EATON HYDRO TESTING

For testing procedure, refer to Hydraulic Section, page 6-3.

## HYDROSTATIC REPAIR

### SUNDSTRAND HYDRO REPAIR

If trouble shooting and pressure checks indicate a need for disassembly of the hydrostatic for repair, the unit must be removed from the tractor. After removal, the open ports should be sealed off and the external surface thoroughly cleaned in a mild cleaning solvent. **IMPORTANT:** Do not use a cleaning solvent that is harmful to paint or rubber.

To simplify the repair of the hydrostatic it will be discussed in four basic sections:

1. Charge pump section
2. Pump section
3. Center section
4. Motor section

#### NOTE:

**BEFORE DISASSEMBLY OF THE VARIOUS SECTIONS, A LINE SHOULD BE SCRIBED ACROSS THE TOP OF THE TRANSMISSION SO THE PROPER POSITIONS OF THE SECTIONS WILL BE MAINTAINED DURING REASSEMBLY.**

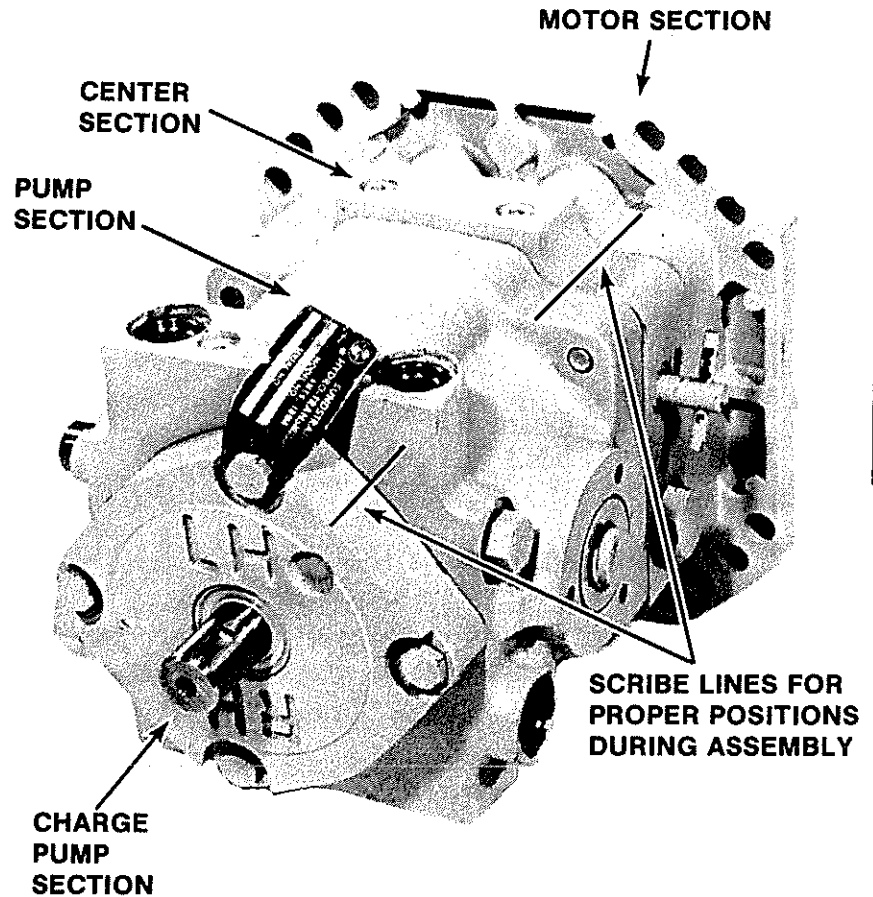


FIGURE 3-14

### HYDROSTATIC EXPLODED VIEW

- |                           |                                |                                  |
|---------------------------|--------------------------------|----------------------------------|
| 1 Cap Screw               | 20 Acceleration Valve Spring   | 39 Hex Plug (Implement)          |
| 2 Bearing                 | 21 Acceleration Valve Assembly | 40 Snap Ring (Later Models)      |
| 3 Motor Housing           | 22 "O" Ring                    | 41 Shim Pack                     |
| 4 Thrust Plate            | 23 Hex Plug                    | 42 Charge Relief Valve Spring    |
| 5 Motor Shaft             | 24 Center Section              | 43 Poppet Valve (Charge)         |
| 6 Cylinder Block Assembly | 25 Pump Valve Plate            | 44 Poppet Valve (Implement)      |
| 7 Check Valve Cap         | 26 Pump Shaft                  | 45 Hex Plug                      |
| 8 "O" Ring                | 27 Roll Pins                   | 46 Filter Union                  |
| 9 Spring                  | 28 Pump Swash Plate            | 47 Implement Relief Valve Spring |
| 10 Ball                   | 29 Snap Ring                   | 48 "O" Ring                      |
| 11 Pipe Plugs             | 30 Bearing                     | 49 Drive Pin                     |
| 12 Gaskets                | 31 Snap Ring                   | 50 Charge Pump (Gerotor)         |
| 13 "O" Ring               | 32 Pump Housing                | 51 Bearing                       |
| 14 Back Up Ring           | 33 Control Shaft               | 52 Charge Pump Housing           |
| 15 Free Wheeling Valve    | 34 Bearing                     | 53 Seal                          |
| 16 Motor Valve Plate      | 35 Seal                        | 54 Identification Tag            |
| 17 Pin                    | 36 Washer                      | 55 Cap Screw                     |
| 18 Bearing                | 37 Retaining Ring              | 56 Hex Plug (Charge)             |
| 19 "O" Ring               | 38 Trunnion Shaft              |                                  |

LEGEND FOR FIGURE 3-15

## DRIVE TRAIN (Continued)

### HYDROSTATIC REPAIR

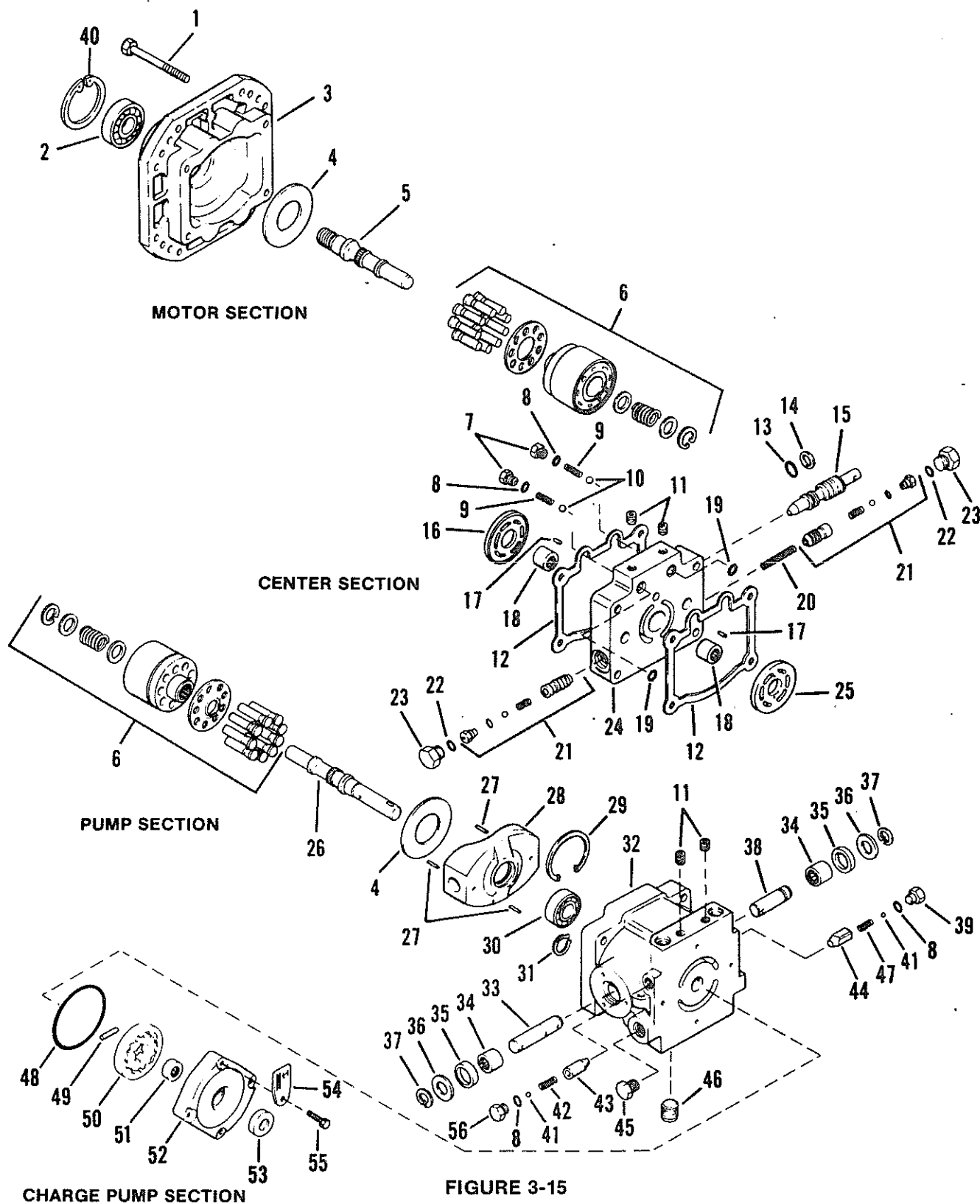


FIGURE 3-15

## HYDROSTATIC REPAIR

### REMOVAL OF CHARGE PUMP

1. Before removing housing, inspect the input shaft especially the keyway, for burrs or sharp edges that could damage the lip seal.
2. Remove the four capscrews and pull housing off the input shaft.
3. The charge pump "O" ring, drive pin, gerotor assembly, bearing and seal can now be inspected and replaced if necessary.

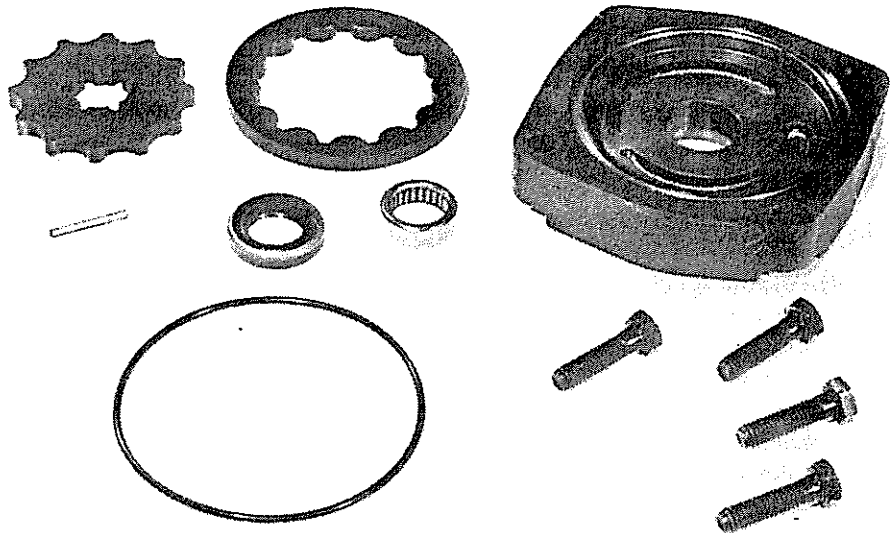


FIGURE 3-16

### CHARGE PUMP INSPECTION

**NOTE:**  
THE CHARGE PUMP USES A NEEDLE BEARING, SMALL DIAMETER SEAL, AND A HARDENED INPUT SHAFT. THE HARDENED INPUT SHAFT IS NEEDED TO PROVIDE THE INNER RACE FOR THE NEEDLE BEARING.

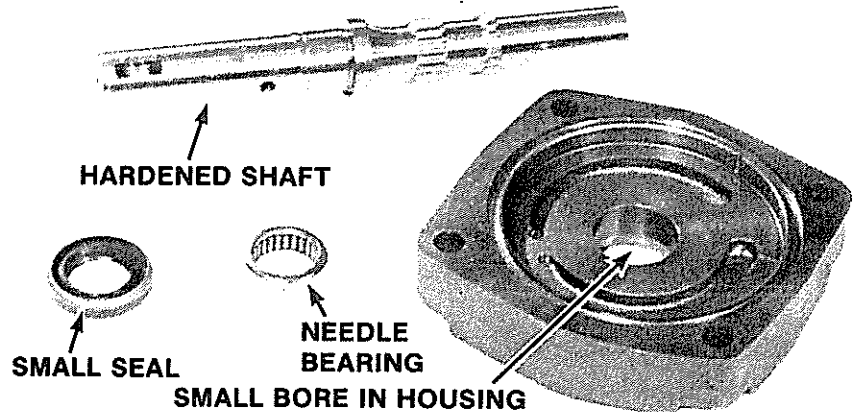


FIGURE 3-17

1. The gerotor surface should be inspected on both sides for grooves or pick-up of foreign material.
2. The drive pin should be inspected for cracks or fatigue points.
3. The charge pump oil cavity lead-ins and inner housing surface should be inspected for damage or excessive wear.

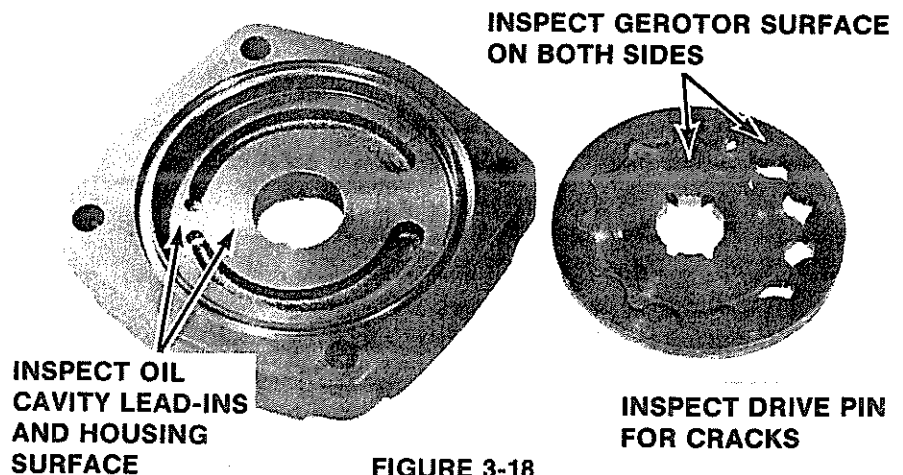


FIGURE 3-18

Damaged or worn parts should be replaced.

## DRIVE TRAIN (Continued)

### HYDROSTATIC REPAIR

#### SEPARATING PUMP, MOTOR AND CENTER SECTIONS

1. Set the hydrostatic pump end down on a soft wooden block with a center hole for the input shaft to extend into.
2. Remove the four capscrews located in the motor section which hold the 3 sections together. Remove all screws equally to prevent damage to threads or surfaces. The three sections are somewhat spring loaded so care must be taken to prevent the transmission from falling apart.
3. When the four capscrews have been removed, the transmission should separate into the three basic sections.

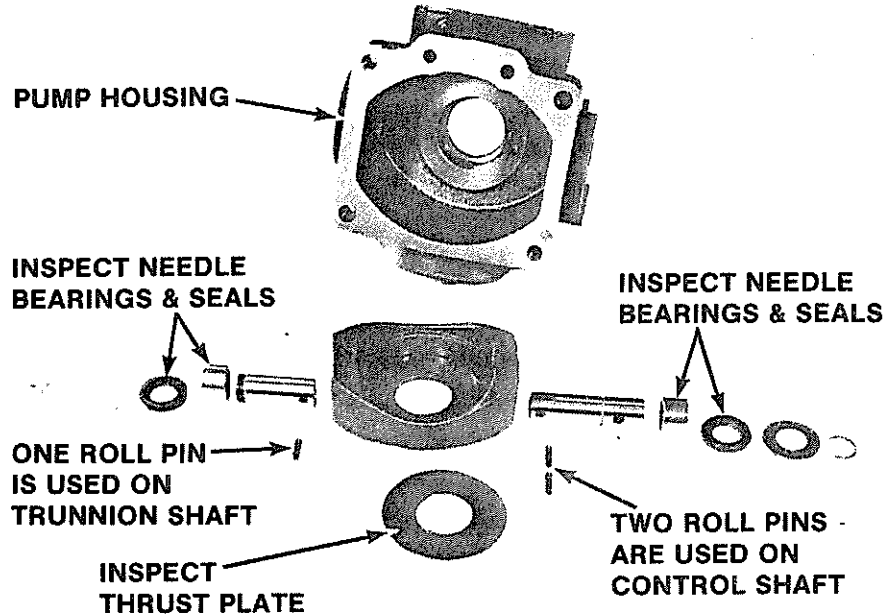


FIGURE 3-19

#### DISASSEMBLY OF PUMP SECTION

1. Remove cylinder block assembly from pump housing.
2. Remove thrust plate from swash-plate.
3. Remove pump variable swash-plate.
  - A. Set pump housing, charge pump end down on a soft wooden block with a center hole for input shaft to extend into.
  - B. With a punch and light hammer tap spring roll pins through variable swash-plate.

**NOTE:**  
**EXCESSIVE HEAVY**  
**POUNDING MAY**  
**DAMAGE BEARINGS**

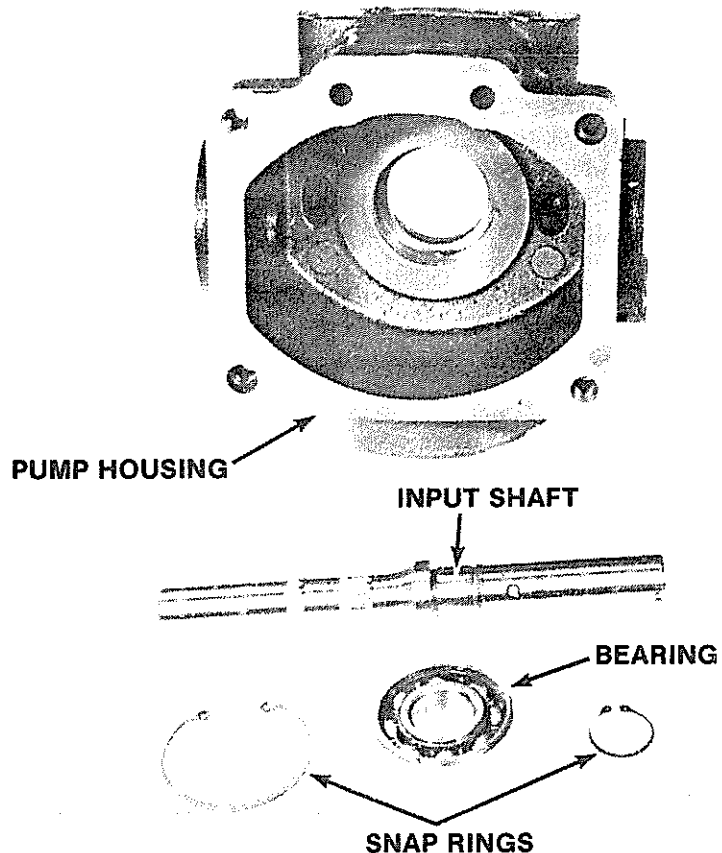


FIGURE 3-20



## HYDROSTATIC REPAIR

- C. Push shafts from swash-plate and housing and remove the swash-plate.
- D. Press the needle bearings from housing.
- 4. Remove pump driveshaft.
  - A. Remove snap rings.
  - B. Tap lightly on input end of pump shaft with a soft hammer to remove the bearing and shaft.
  - C. Press bearing from drive-shaft.

### INSPECTION OF PUMP SECTION

- 1. Inspect control and trunnion shaft bearings and seals.
- 2. Inspect thrust plate for scratches or wear. Replace all worn or damaged parts.

### INSPECTING CYLINDER BLOCK ASSEMBLIES

The pump cylinder block and the motor cylinder block are identical.

- 1. Inspect the cylinder blocks for wear or pickup of foreign material.
- 2. Inspect the piston retainer for straightness. The retainer must be straight so the piston slipper surfaces will not wear uneven.
- 3. Inspect the piston assembly. The lubricant hole must be free of obstruction and the slipper surface even. If the slipper surface has more than 1/32" taper, the cylinder block assembly must be replaced.

Individual parts are not available for the cylinder blocks because of the close tolerances. If any problem is evident the complete cylinder block must be replaced.

INSPECT CYLINDER BLOCK  
FOR WEAR OR PICK-UP OF  
FOREIGN MATERIAL

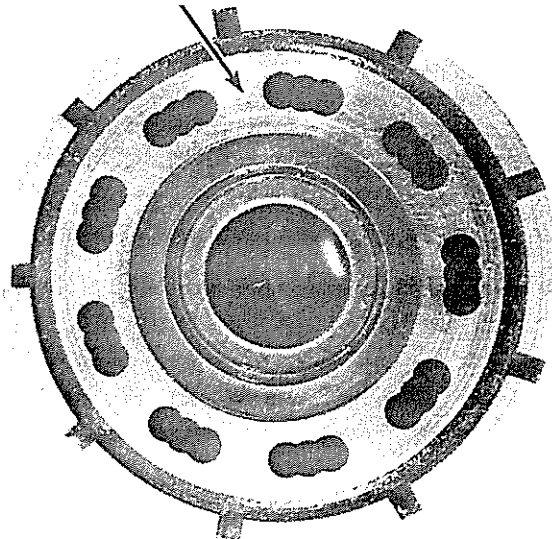
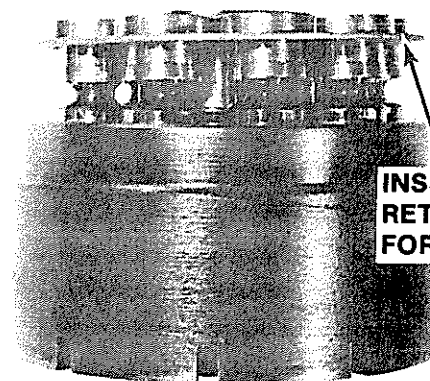


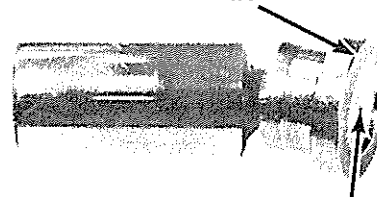
FIGURE 3-21



INSPECT PISTON  
RETAINER PLATE  
FOR STRAIGHTNESS

FIGURE 3-22

INSPECT SLIPPER  
SURFACE FOR WEAR



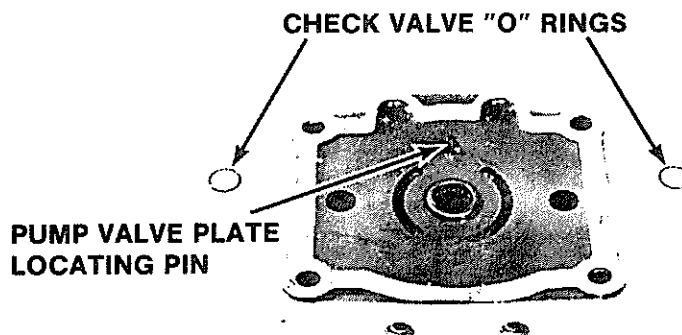
LUBRICANT HOLE MUST  
BE FREE OF  
OBSTRUCTION

FIGURE 3-23

## HYDROSTATIC REPAIR

### DISASSEMBLY OF CENTER SECTION

1. Remove valve plates and valve plate locating pins.
2. Remove gaskets.
3. Remove bearings.
4. Remove check valve "O" rings, pump side and check valves, motor side.

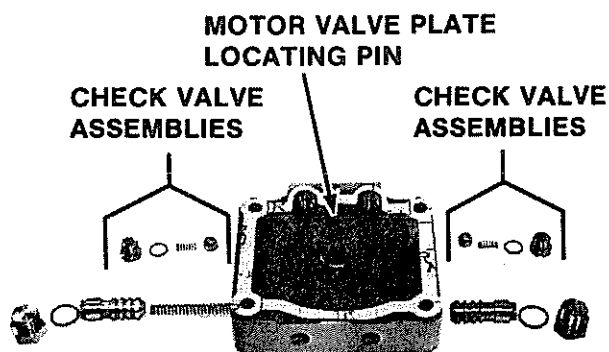


PUMP SIDE OF CENTER SECTION

FIGURE 3-24

### INSPECTION OF CENTER SECTION

1. Inspect bearings.
2. Inspect check valves and check valve seats. Make sure check valves operate freely.
3. Inspect back side of motor and pump valve plates for dirt or wear in the locating pin slots.



MOTOR SIDE OF CENTER SECTION

FIGURE 3-25

### PUMP AND MOTOR VALVE PLATE IDENTIFICATION

Since the pump cylinder block assembly only turns in the Left hand or clockwise rotation, the lead-ins in the pump valve plate are located for Left hand rotation only. The motor cylinder block assembly turns in both directions thus the motor valve plate has lead-ins for both right and Left hand rotation.

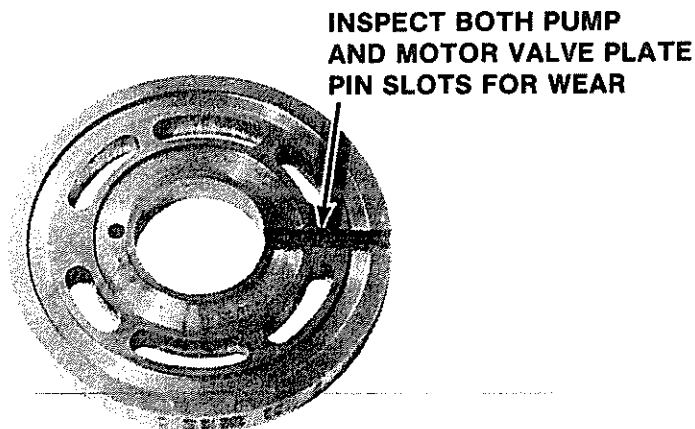


FIGURE 3-26

## HYDROSTATIC REPAIR

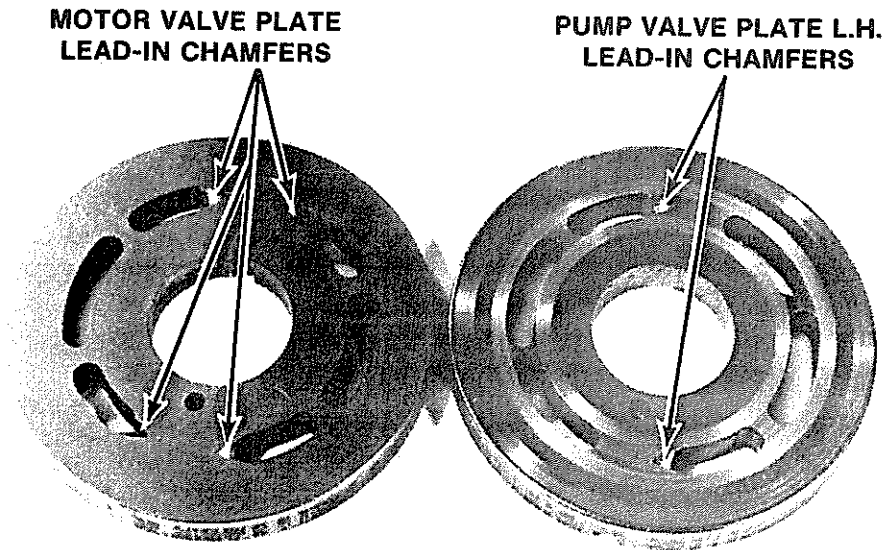


FIGURE 3-27

### DISASSEMBLY OF MOTOR SECTION

1. Remove cylinder block assembly.
2. Remove thrust plate.
3. Remove Snap Ring (Later Models).
4. Tap on internal end of motor shaft to remove shaft and bearing from housing.
5. Press bearing from motor shaft.

### INSPECTION OF MOTOR SECTION

1. Inspect thrust plate for scratches or wear. Replace all worn or damaged parts.

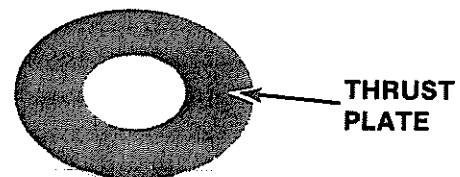
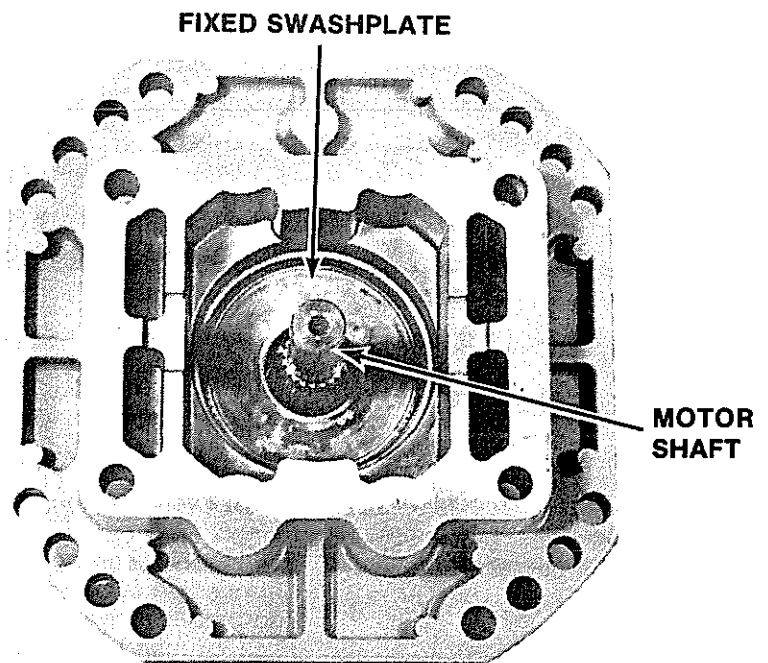


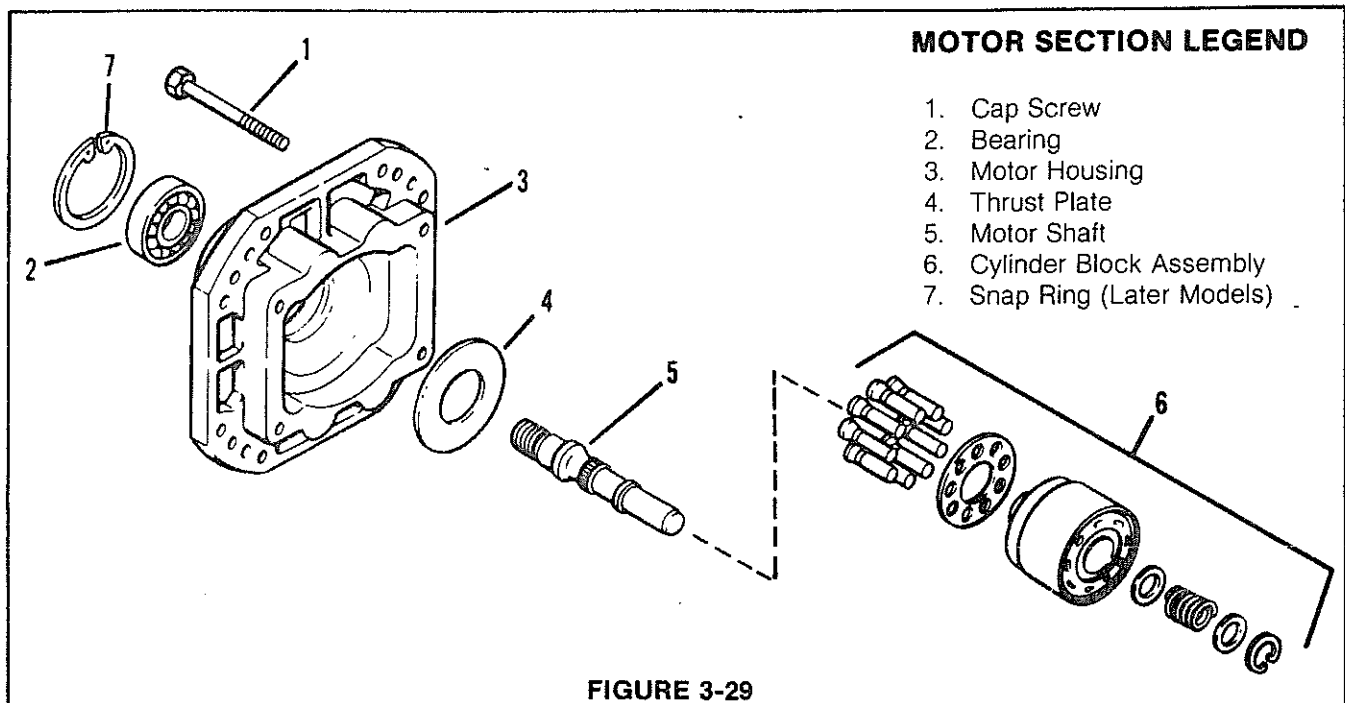
FIGURE 3-28

## DRIVE TRAIN (Continued)

### HYDROSTATIC REPAIR

#### ASSEMBLY OF MOTOR SECTION

1. Press bearing to shoulder on motor shaft.
2. Install motor shaft and bearing into housing.
3. Install Snap Ring (Later Models).
4. Install thrust plate onto motor housing swashplate.
5. Align Splines of cylinder block assembly with splines of motor shaft and install into housing.



#### ASSEMBLY OF CENTER SECTION

1. Install bearings into center section. Bearings must protrude .100 inch from polished surface, printed end out.
2. Install check valves on motor side of center section. Torque check valves to 10 ft. lbs.
3. Install "O" rings to pump side of center section.
4. Install valve plate pins and valve plates. The pump valve plate has two lead-ins and goes on the pump side of center section and the motor valve plate has four lead-ins and goes to the motor side of center section.
5. Use new gaskets on both sides of center section.

## HYDROSTATIC REPAIR

### CENTER SECTION LEGEND

1. Check Valve Cap
2. "O" Ring
3. Spring
4. Ball
5. Pipe Plugs
6. Gaskets
7. "O" Ring
8. Back Up Ring
9. Free Wheeling Valve
10. Motor Valve Plate
11. Pin
12. Bearing
13. "O" Ring
14. Acceleration Valve Spring
15. Acceleration Valve Assembly
16. "O" Ring
17. Hex Plug
18. Center Section
19. Pump Valve Plate

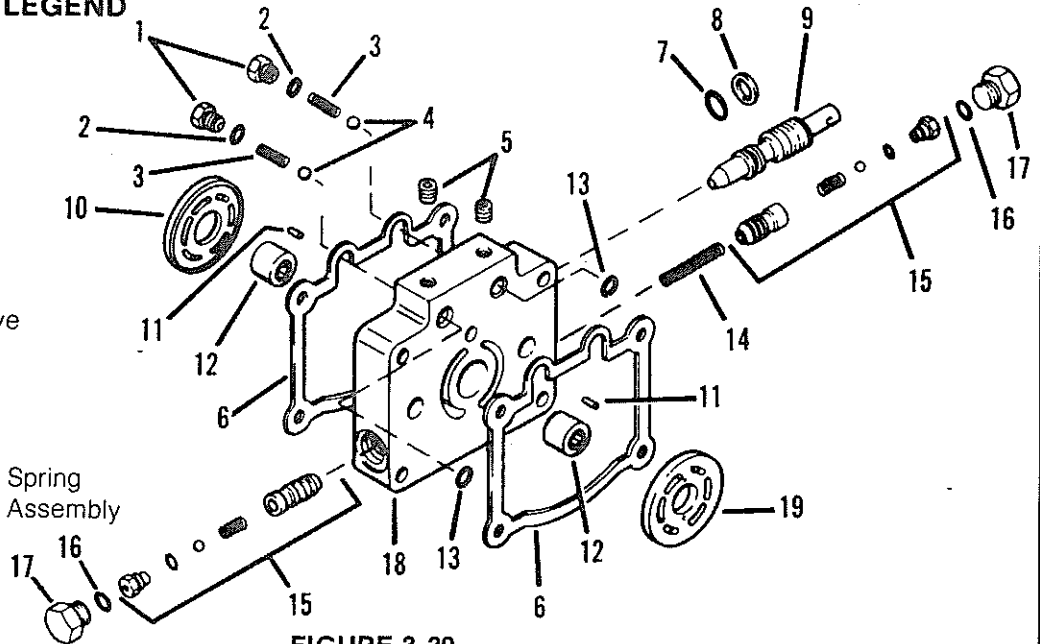


FIGURE 3-30

### MOTOR VALVE PLATE LEAD-IN CHAMFERS

### PUMP VALVE PLATE L.H. LEAD-IN CHAMFERS

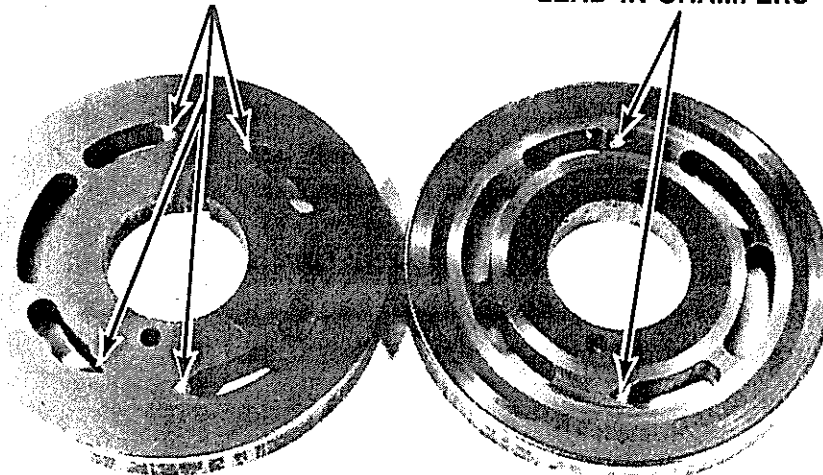


FIGURE 3-31

### ASSEMBLY OF PUMP SECTION

1. Press bearings into housing, lettered edge out, until flush to .005" below lip seal recess of housing.
2. Press bearing on pump shaft to shoulder.
3. Install input shaft and bearing into housing.
4. Position pump housing with check valve passageways up.
5. Place swashplate over drive-shaft into housing.

# DRIVE TRAIN (Continued)

## HYDROSTATIC REPAIR

6. Insert shorter trunnion shaft into housing and swashplate from left side and longer control shaft (small hole end) into housing and swashplate from right side.
7. Install the spring roll pins. Two on control shaft side, one on trunnion shaft side. Proper installation is when pins are 1/4" into swashplate.
8. Install thrust plate to swashplate.
9. Align splines of cylinder block kit with input shaft splines and install into housing.

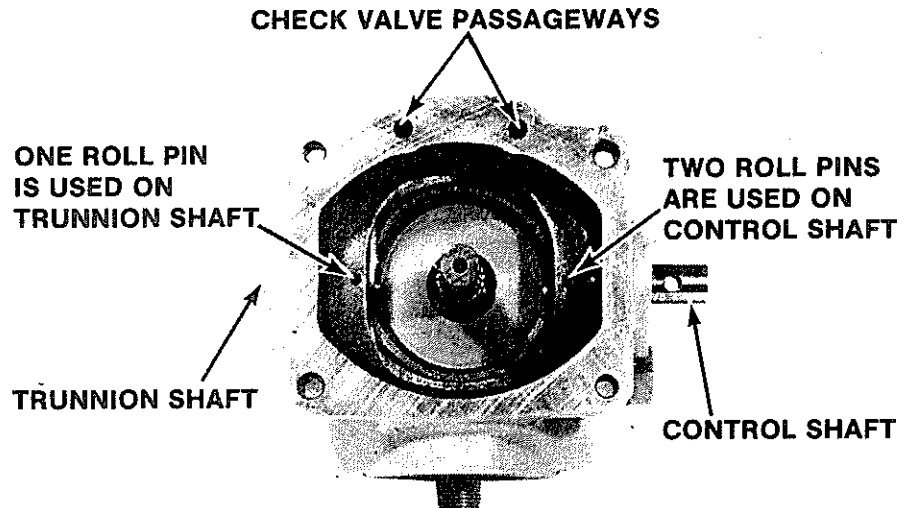


FIGURE 3-32

### PUMP SECTION LEGEND

1. Cylinder Block Assembly
2. Pump Shaft
3. Key
4. Thrust Plate
5. Pin
6. Pump Swashplate
7. Snap Ring
8. Bearing
9. Snap Ring
10. Pump Housing
11. Pipe Plugs
12. Control Shaft
13. Bearing
14. Seal
15. Washer
16. Retaining Ring
17. Trunnion Shaft
18. Hex Plug (Implement)
19. "O" Ring
20. Shim Pack
21. Charge Relief Valve Spring
22. Poppet Valve
23. Implement Relief Valve Spring
24. Hex Plug
25. Filter Union
26. Poppet Valve
27. Hex Plug (Charge)

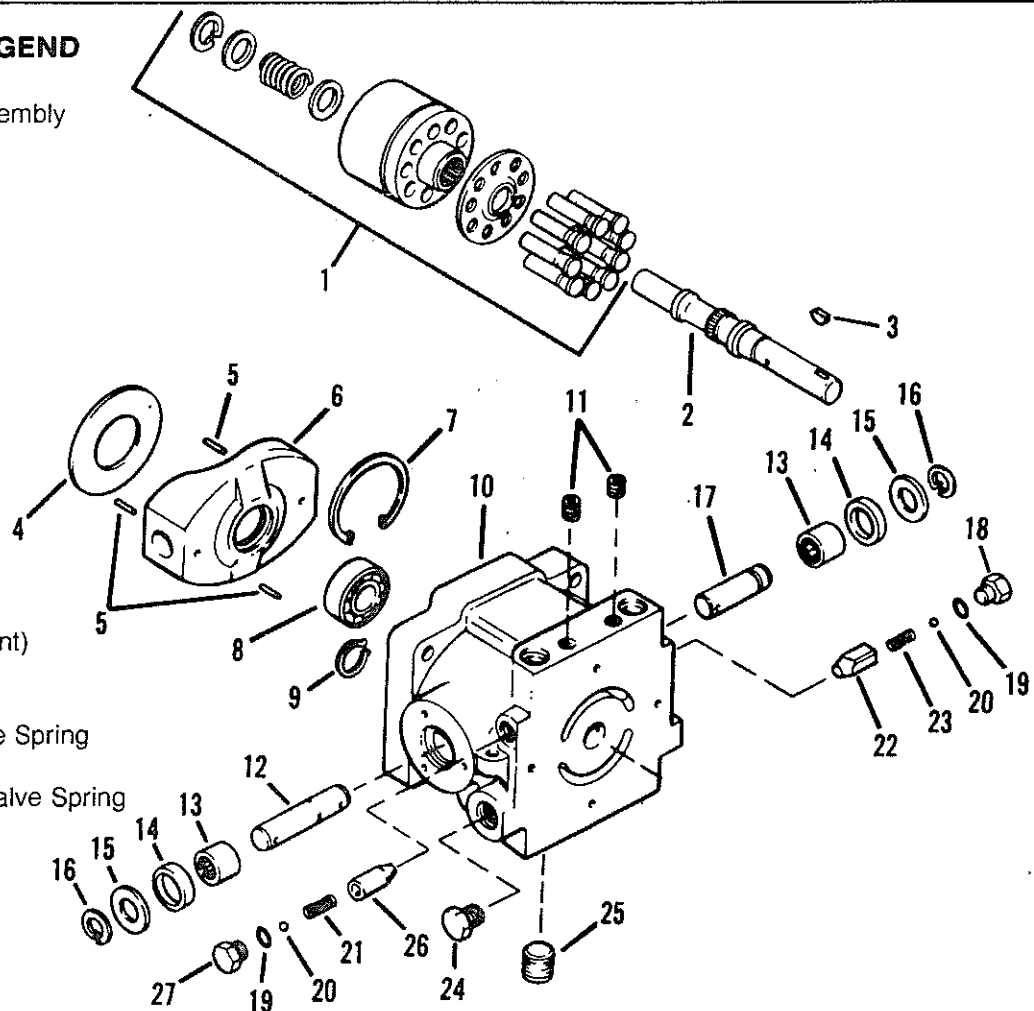


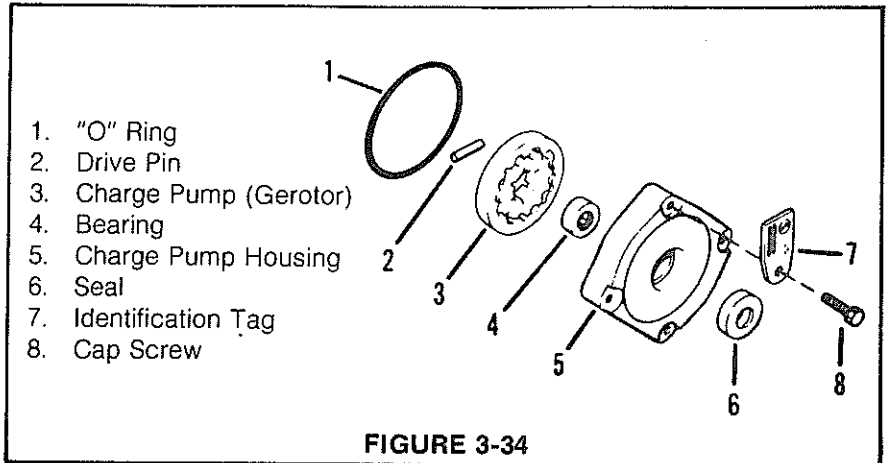
FIGURE 3-33

## HYDROSTATIC REPAIR

### ASSEMBLY PROCEDURE OF CHARGE PUMP

Clean all parts and lubricate with new hydrostatic transmission fluid before assembly.

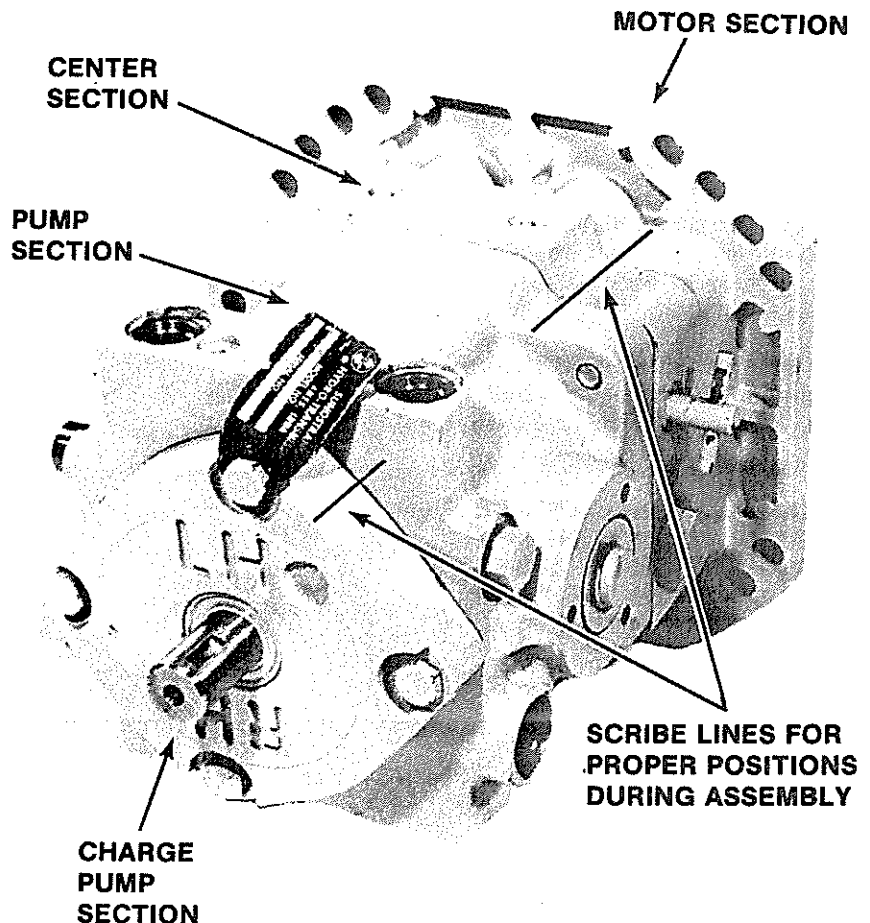
1. Install the input shaft bearing into the charge pump housing. Bearing must be installed from the inside and be flush to .005" below its bore, with the lettered side out.
2. Install the seal into the housing until seated. Press only on the outer edge.
3. Install new "O" ring into housing groove.
4. Install drive pin into hole in input shaft.
5. Install gerotor assembly over drive pin.
6. Install charge pump housing. Be careful not to damage lip seal. Torque capscrews to 20 ft. lbs.



### ASSEMBLY OF HYDROSTATIC

1. Align Pump, Center, and Motor sections properly.
2. Install the 4 capscrews and torque to 35 ft. lbs.
3. Check the torque needed to turn the input shaft, output shaft, and control shaft. Torque reading should not exceed 25 in. lbs.

**NOTE:**  
IF TORQUE EXCEEDS THIS AMOUNT, HYDRO WILL HAVE TO BE DISASSEMBLED TO LOCATE BINDING.



## TRANSAXLE ASSEMBLY PROCEDURE

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

### ASSEMBLY PROCEDURE OF THE CARRIER AND AXLE

A snap ring is used to hold the side gears on the splined axle shafts.

**CAUTION:**  
MAKE SURE THE SNAP RING IS SEATED PROPERLY IN THE GROOVE.

The two pinion gears slide on the pinion shaft and are held in position by the side gears when the carrier is assembled.

The pinion shaft is a slip fit into the machined grooves in the bull gear.

**NOTE:**  
WHEN ASSEMBLING, REPLACE OLD PINION GEARS WITH NEW GEARS. INSTALL A WEAR WASHER BETWEEN THE GEAR AND BULL GEAR HOUSING, AS SHOWN IN FIGURE 3-38.

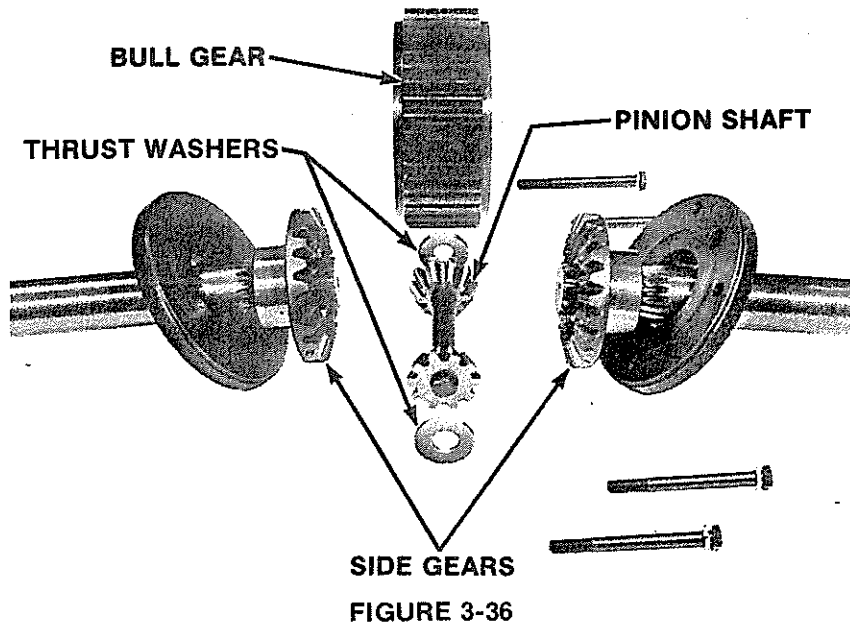


FIGURE 3-36

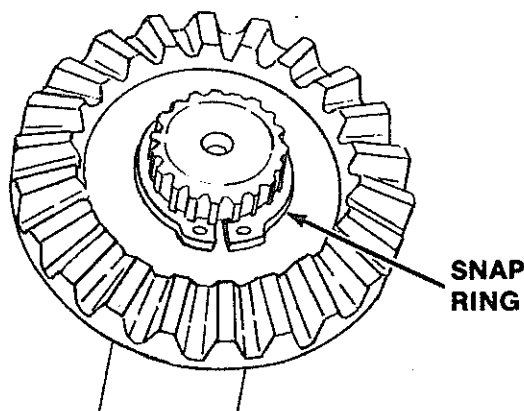


FIGURE 3-37

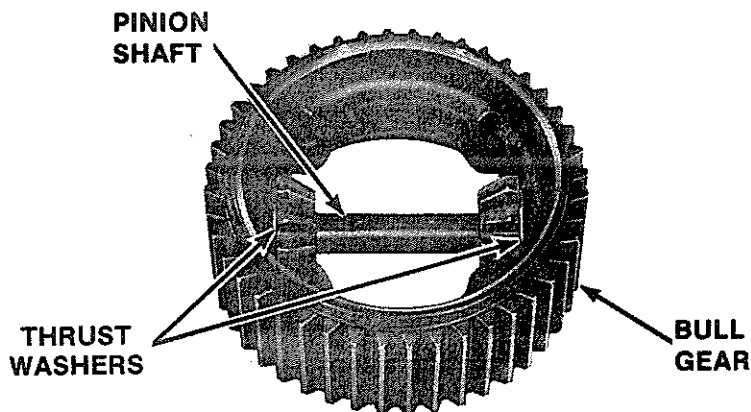


FIGURE 3-38



## TRANSAXLE ASSEMBLY

The carrier side plates hold the assembly together and are bolted with four 5/16-18 x 3-1/2" cap-screws. These four bolts should be torqued to 30 ft. lbs. (41 N.m)

### CHECKING TRANSAXLE CLEARANCES

Check cluster gear and axle shaft end play. The end play should be .005 to .030 (0.13 to 0.76 mm). If the clearance is greater than .030 (0.76 mm) shims must be installed. The right side housing must be removed and the correct number of shims installed until end play is between .005 to .030 (0.13 to 0.76 mm).

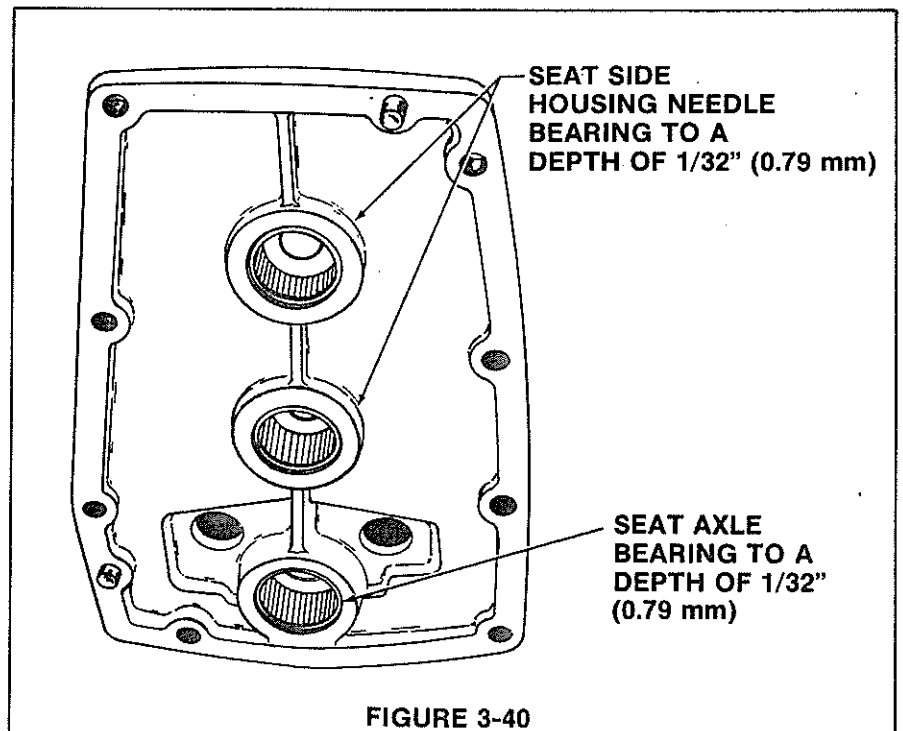
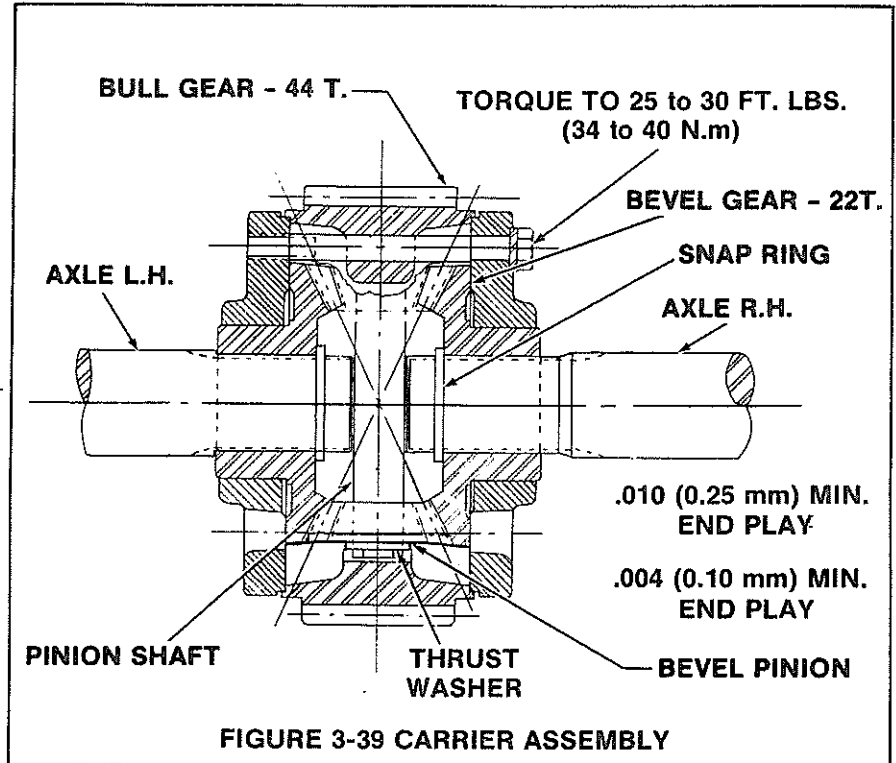
Cluster gear end play can be checked between thrust washer and side of housing using a feeler gauge. A dial indicator may also be used.

The axle shaft end play can be checked between the spacer and the carrier side plate.

### ASSEMBLY PROCEDURE OF TRANSAXLE HOUSING

Check needle bearings in side housings: If needles show signs of pitting or any other damage replace them. Use a needle bearing driver and seat bearing to a depth of 1/32" (0.8 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.**

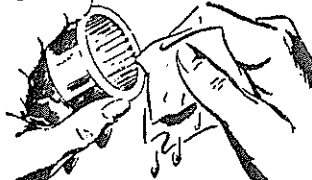


# DRIVE TRAIN (Continued)

## TRANSAXLE ASSEMBLY

### BEARING INSTALLATION

**Don't**

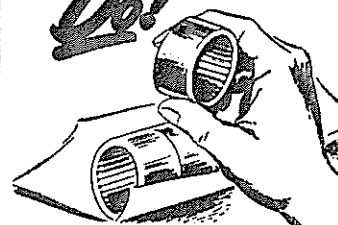


### LUBRICANT

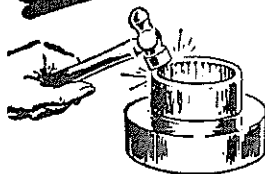
**DON'T** try to wipe or wash the lubricant out of needle bearings. It is a tough, tricky job and is not necessary.

**DO** install bearings with original lubricant left in them —more can be added after installation.

**Do!**



**Don't**

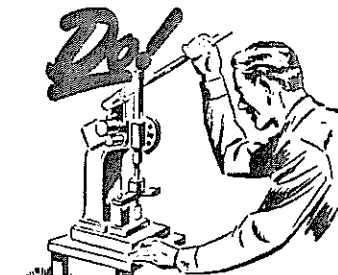


### INSTALL CORRECTLY

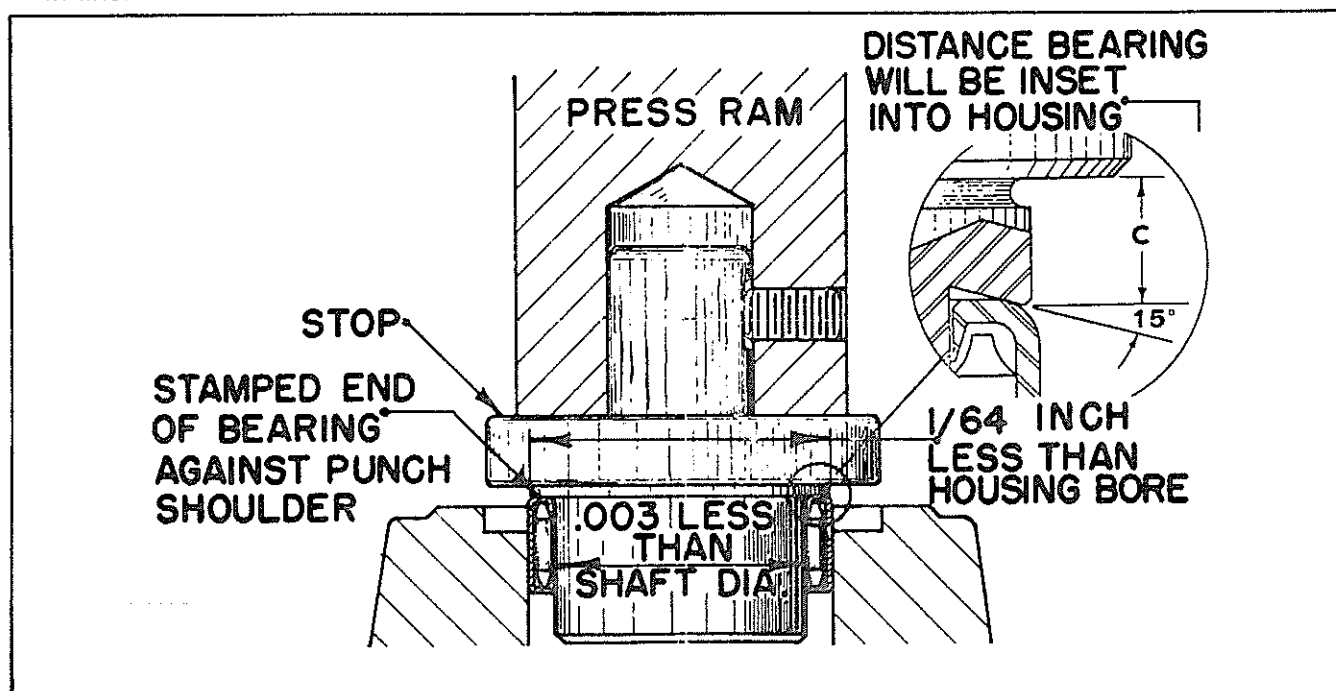
**DON'T** hammer a bearing into a housing! You are sure to damage the bearing. Don't guess at housing bore size—get it from our catalog.

**DO** press bearings into housing with an arbor press using a pilot punch. First place round or plain end of bearing in housing; then use press against stamped end.

**Do!**



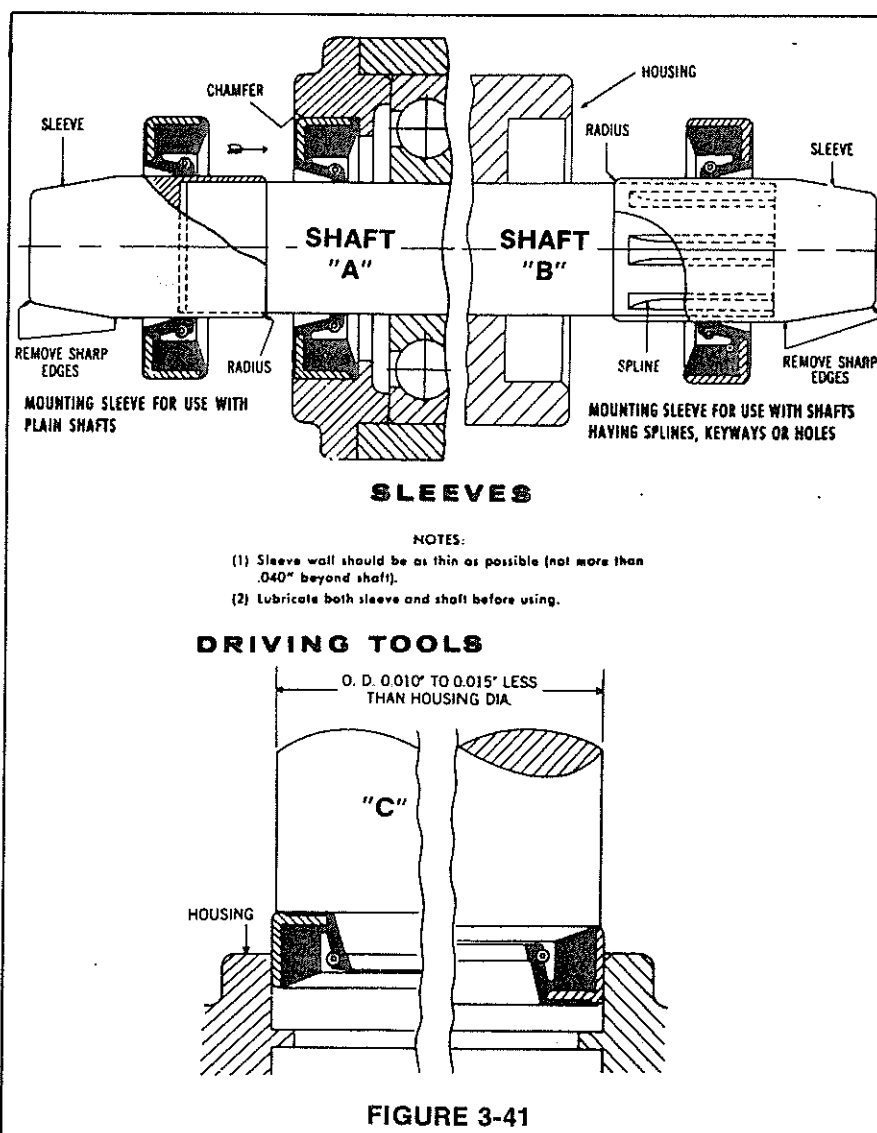
1. Use an arbor press, as illustrated, or a similar method where possible.
2. The punch should have a pilot, as shown, to keep the Bearing in line.
3. Place the stamped end of the Bearing against the shoulder of the punch, because the unstamped end of the Bearing will lead best into the housing bore.
4. Leave the grease on the outside of Bearing. Do not wipe them. Keep the Bearings clean.



## OIL SEAL INSTALLATION

### 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.
2. Provide radius or chamfer at housing bore entrance.
3. Be sure sealing lip has not been damaged.
4. Lubricate sealing lip(s) with any light machine oil before installing.
5. Apply a light coat of any suitable Sealing Compound to O.D. of seal to provide a margin of safety against seepage through the pressfit in housing bore. Extreme care must be taken to avoid depositing any compound on the sealing member.
6. Install seal with lip facing medium to be sealed. (The reverse is used only when it becomes more important to exclude a medium than to retain it.)
7. When possible, chamfer end of shaft over which seal must pass; otherwise use a sleeve as illustrated at "A" or "B" in Figure 3-60.
8. Press seal into housing with smooth uniform pressure applied by means of a pressfitting tool. See "C" in Figure 3-60. If shaft is already in place, use a sleeve-type pressfitting tool.
9. Whenever possible, use an arbor press to insert seal into housing. Be sure seal is not cocked when applying pressure. It is desirable to seat seal against a shoulder in the bore to help prevent cocking.
10. When 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 must be used made to the dimensions shown at "A" in Figure 3-60. When seal must pass splines, keyways or holes use a sleeve as shown at "B" in Figure 3-60. If the use of an assembly sleeve is not possible, the edges of the spline, keyway or holes should be rounded and lubricated with a heavy grease.
11. In cases where the completed machine is painted where seal is exposed, mask area to prevent paint being deposited on shaft and sealing lip. If paint is baked on, be sure temperature does not exceed operating temperature of seal to avoid injury to the sealing member.



# DRIVE TRAIN (Continued)

Needle bearings in end of axle housing should be seated  $\frac{1}{32}$ " to  $\frac{1}{16}$ " (0.8 to 1.6 mm) below counter bore for the axle seal.

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

Install carrier and axle assembly into the left side housing. Be careful not to damage axle seal in end of housing. See Figure 3-43.

Bolt left side housing with axle assembly to the center housing. Make sure new gasket has been installed and torque housing cap-screws to 30 ft. lbs. (40 N.m).

The bevel gear can be removed from the shaft if replacement is necessary. A woodruff key is used to prevent the bevel gear from turning on the shaft.

An arbor press should be used to press the bevel gear on and off the shaft, Figure 3-44.

If the cluster gear or pinion gear is replaced, make sure part numbers are checked to assure proper gear ratio. See Figure 3-45.

To install bevel gear assembly and cluster gear they must be installed together in their normal position as they are meshed in the transaxle. Make sure thrust washer is installed on cluster gear, and slide shafts into the needle bearings, Figure 3-46.

The right side of the bevel gear must have a torrrington bearing assembly. The cluster gear must have a thrust washer and the axle

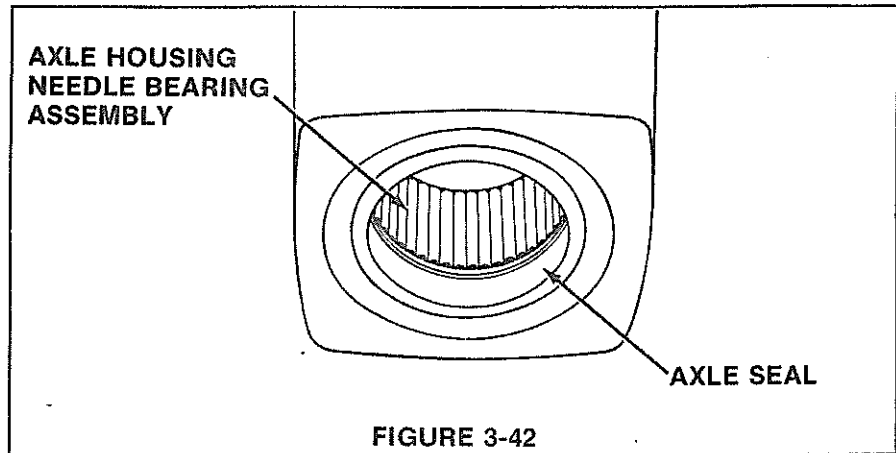


FIGURE 3-42

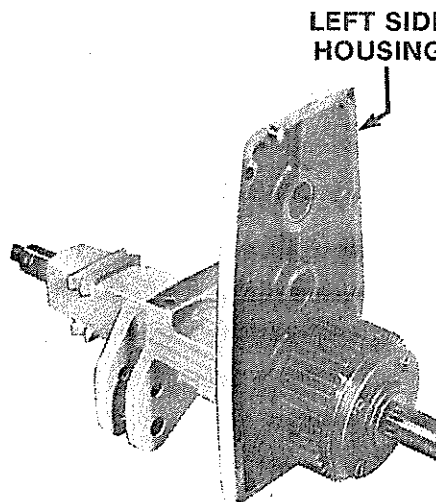


FIGURE 3-43

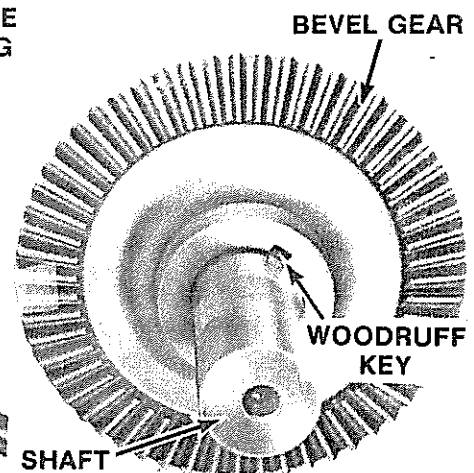


FIGURE 3-44

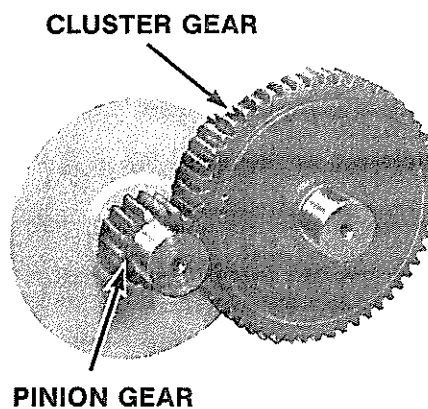


FIGURE 3-45

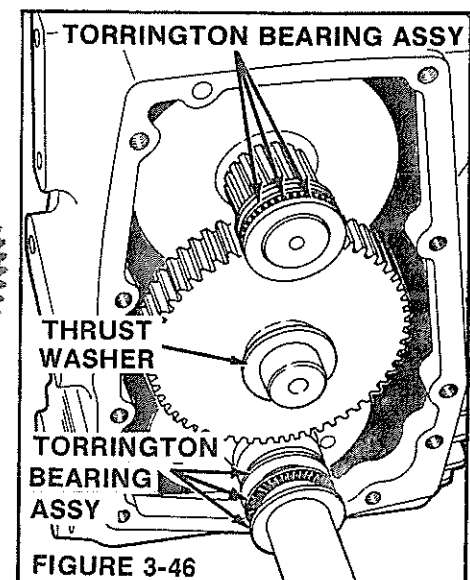


FIGURE 3-46

## TRANSAXLE ASSEMBLY

shaft a spacer and torringon bearing assembly. After the bearings and spacers are installed, the right side housing can be bolted in place. Be careful not to damage axle seal. Use a new gasket and torque cap-screws to 30 ft. lbs. (40 Nm).

### CHECKING TRANSAXLE CLEARANCES

Check cluster gear and axle shaft end play. The end play should be .005 to .030 (0.13-0.76 mm), Figure 3-47. If the clearance is greater than .030 (0.76 mm), shims must be installed. The right side housing must be removed and the correct number of shims installed until end play is between .005 to .030 (0.13-0.76 mm).

Cluster gear end play can be checked between thrust washer and side of housing using a feeler gauge. A dial indicator may also be used.

The axle shaft end play can be checked between the spacer and the carrier side plate, Figure 3-48.

CHECK CLUSTER GEAR  
CLEARANCE BETWEEN  
THRUST WASHER AND  
TRANSMISSION CASE

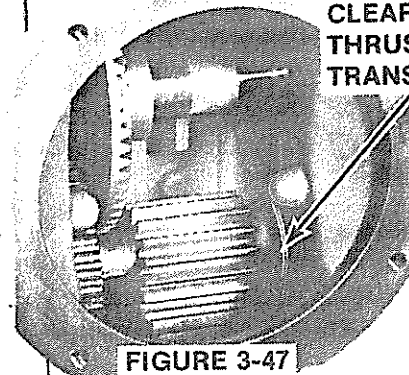
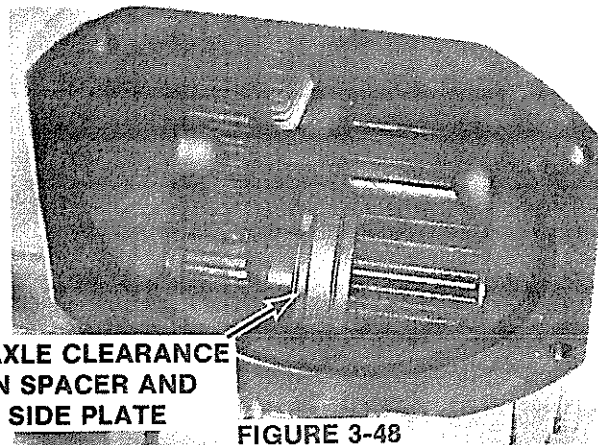


FIGURE 3-47



CHECK AXLE CLEARANCE  
BETWEEN SPACER AND  
CARRIER SIDE PLATE

FIGURE 3-48

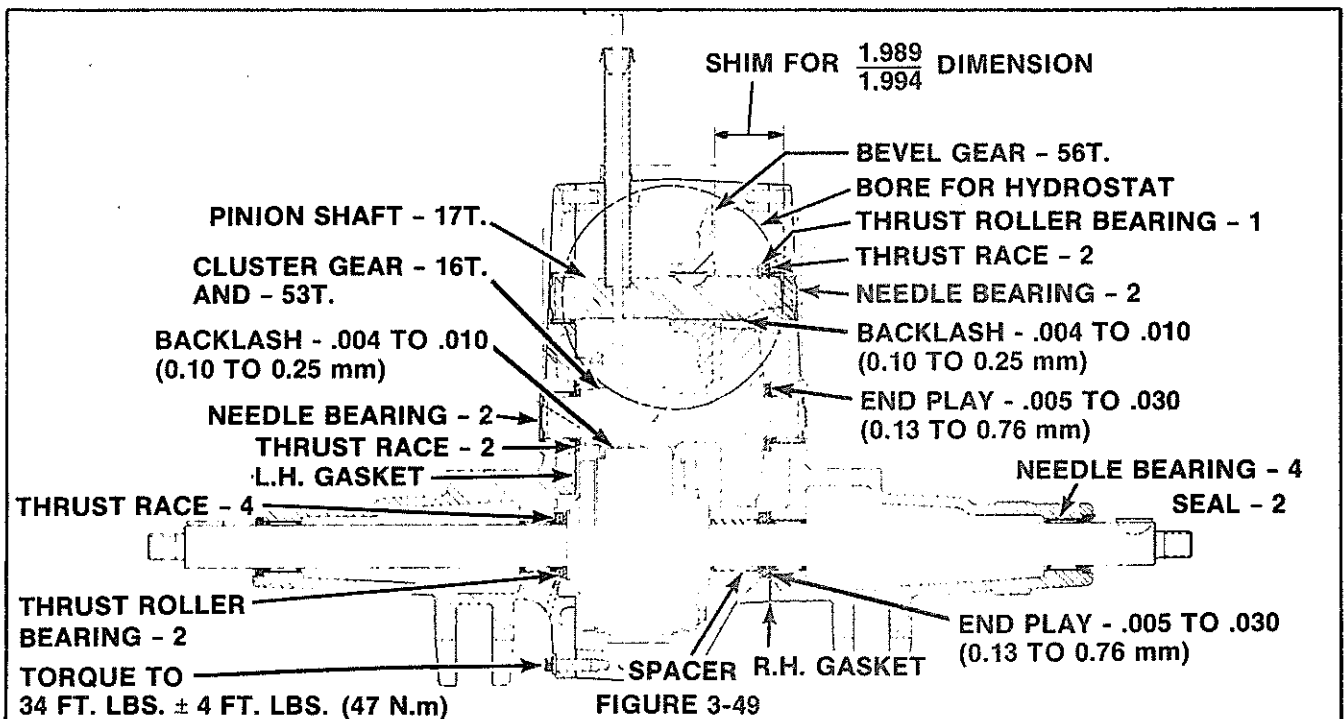


FIGURE 3-49

# DRIVE TRAIN (Continued)

## TRANSAXLE ASSEMBLY

- |                          |                            |                            |
|--------------------------|----------------------------|----------------------------|
| 1. Dipstick              | 12. L.H. Transaxle Cover   | 22. Retaining Ring         |
| 2. Tube                  | 13. R.H. Transaxle Cover   | 23. Pipe Plug              |
| 3. Transaxle Housing     | 14. Lock Washer 5/16       | 24. R.H. Cover Gasket      |
| 4. Oil Seal              | 15. Counterbore Capscrew   | 25. Pinion 10T             |
| 5. Needle Bearing        | 3/8-16 x 1                 | 26. R.H. Axle              |
| 6. Gear 56T              | 16. L.H. Cover Gasket      | 27. Pinion Shaft           |
| 7. Woodruff Key          | 17. Gear Ass'y 45T - 16T   | 28. L.H. Bull Gear Carrier |
| 8. L.H. Axle             | 18. Dowel Pin              | 29. Axle Gear 44T          |
| 9. Pinion Shaft Assy 25T | 19. Shim                   | 30. Hex Hd Screw           |
| 10. Thrust Race          | 20. R.H. Bull Gear Carrier | 5/16-18 x 3-1/2            |
| 11. Thrust Bearing       | 21. Gear 22T               |                            |

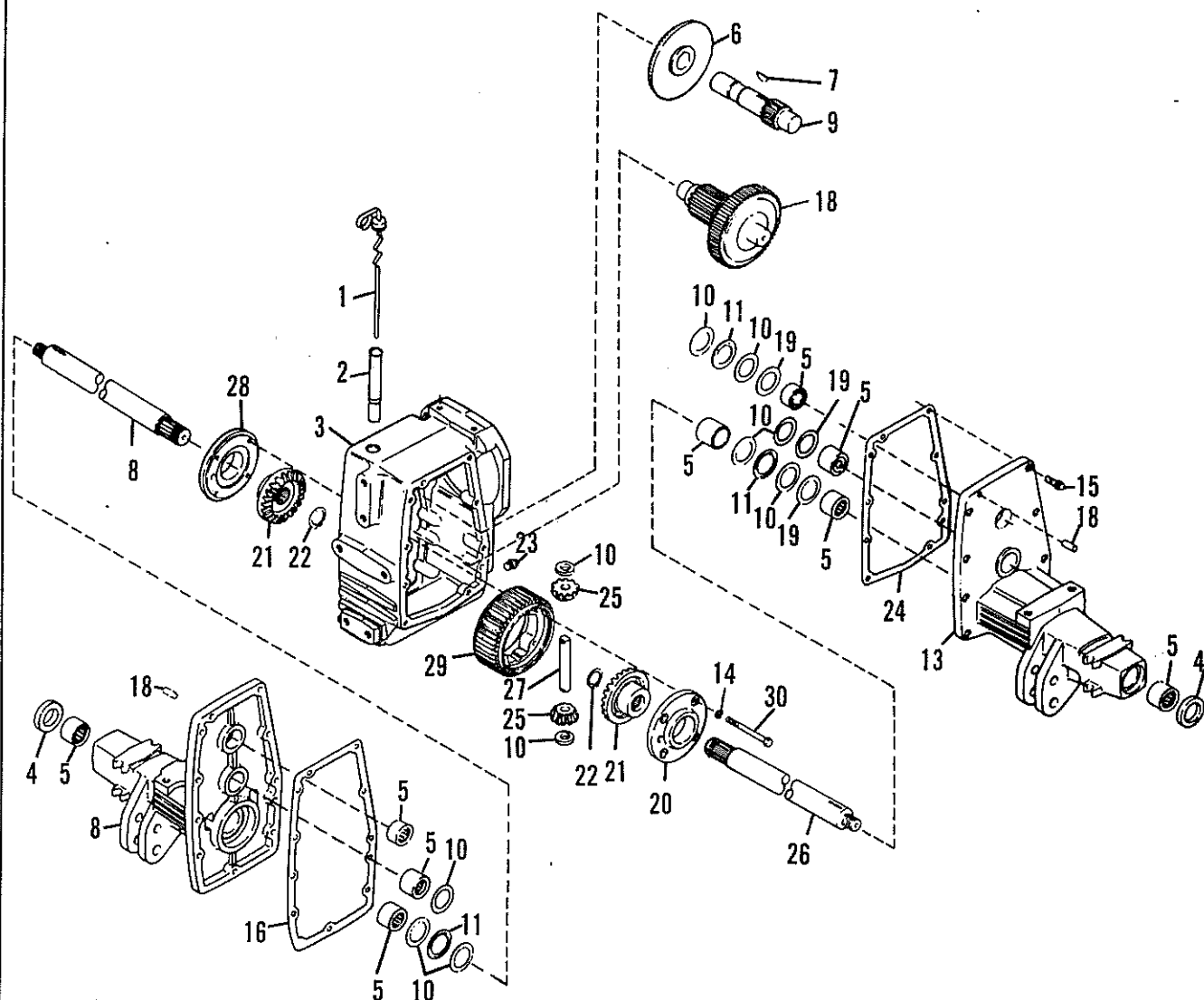


FIGURE 3-50

## HYDROSTATIC REINSTALLATION

### EATON HYDRO

1. Tip the transaxle back and rest on a 6" (15 cm) block.
2. Install spacer, nut (A), and bevel gear (B) on output shaft. Torque nut to 24 ft. lbs. (32.5 N.m).
3. Install control arm assembly (C) to control shaft. Secure with nut and washer.
4. Install hydro to transaxle housing.
5. Install the four mounting screws (D) to secure the hydro and oil filter. Torque nut to 24 ft. lbs. (32.5 N.m).
6. Install the three hydraulic tube fittings.
7. Connect hydraulic suction tube (E).

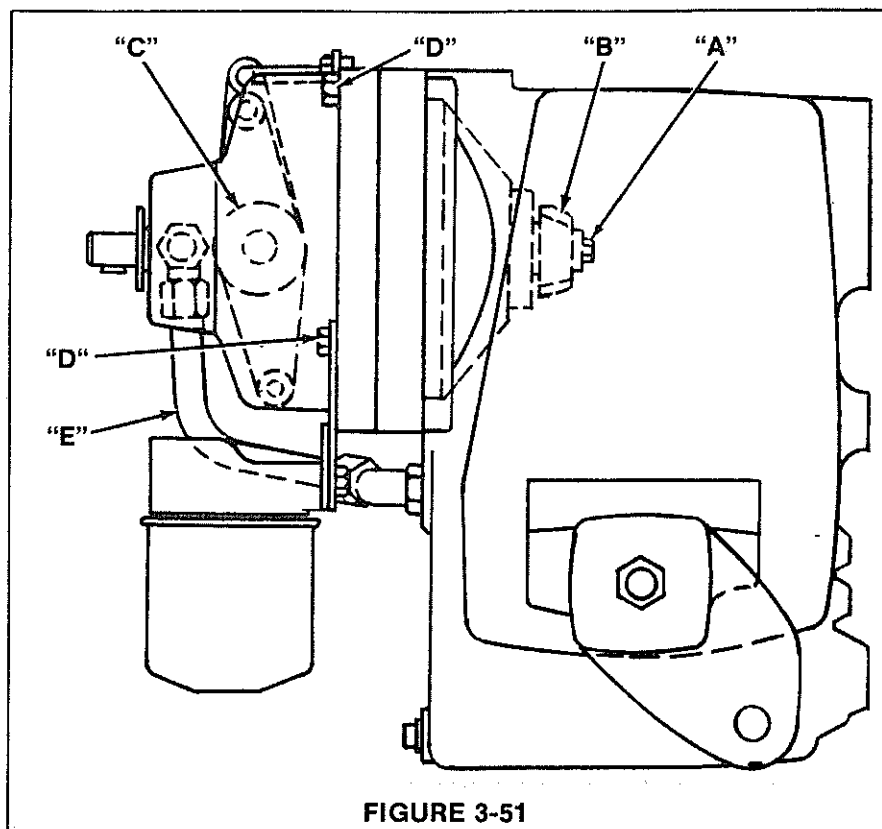


FIGURE 3-51

### SUNDSTRAND HYDRO

1. Remove protection cap from oil filter stud and stake stud to prevent it from turning further into hydro during filter installation.
2. Remove protective tape from oil filter pad on hydro.

**NOTE:**  
IF FILTER IS INSTALLED OVER PROTECTIVE TAPE, OIL PASSAGE WILL BE BLOCKED AND DAMAGE TO THE HYDRO WILL OCCUR.

3. When replacing the hydro package the bevel output gear must be removed from the old hydro and installed

on the new one. The bevel gear is held on with either an external snap ring (fig. 3-52) or a nut (fig. 3-52A). Make sure snap ring is properly installed in the groove. The snap ring should be replaced when it shows signs of weakness or distortion. On hydro package, with nut holding bevel gear, bend the thin washer up around one or two of the flats on the nut to secure it.

4. Install roll pin into free wheeling valve.

**NOTE:**  
BE CAREFUL NOT TO DAMAGE VALVE.

5. Install the two oil line fittings and pick-up tube fitting (fig. 3-9).

Do not tighten packing nuts so fittings can be adjusted to lines.

6. Install gasket onto hydro using grease to hold it in place.

**NOTE:**  
REFER TO OLD HYDRO FOR BOLT PATTERN TO LOCATE GASKET.

7. Install hydro and the three bolts. (Save longer bolt to attach neutral adjusting rod.)

## DRIVE TRAIN (Continued)

8. Install linkage on control shaft and drive in roll pin to hold in place.
9. Install neutral adjusting rod and torque all four bolts to 31 ft. lbs. (42 Nm).
10. Install pick-up tube and tighten packing nut.
11. Install the two hydraulic oil lines and tighten packing nut.

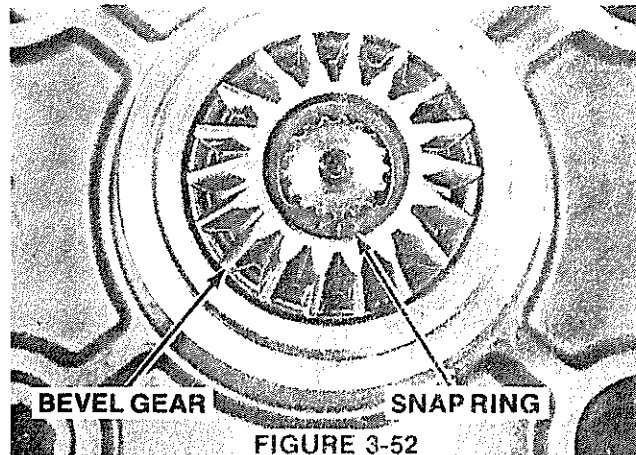


FIGURE 3-52

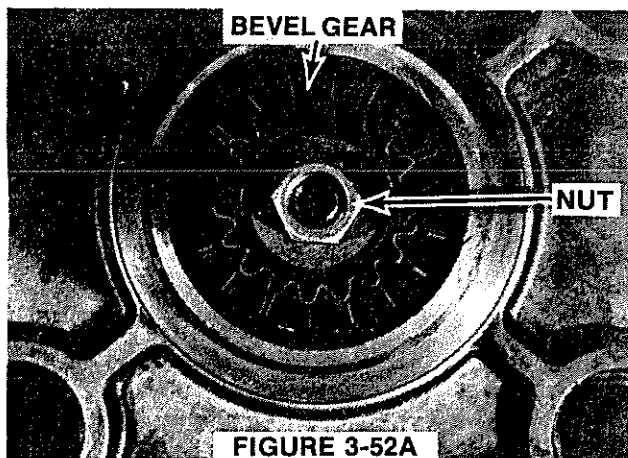


FIGURE 3-52A

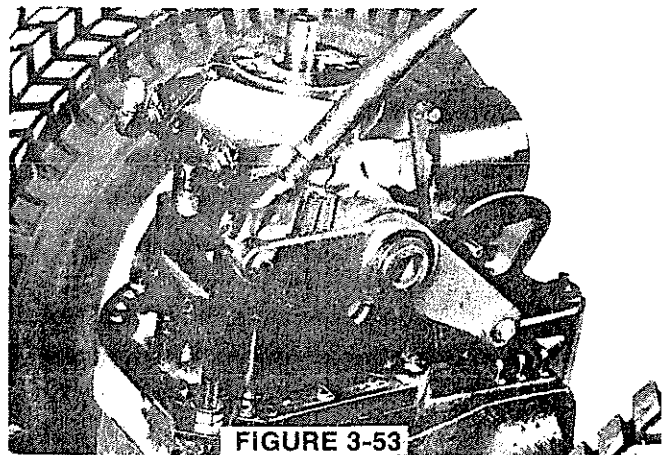


FIGURE 3-53

## TRANSAXLE REINSTALLATION

### EATON HYDRO MODELS

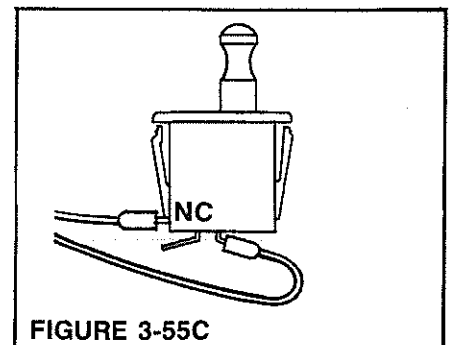
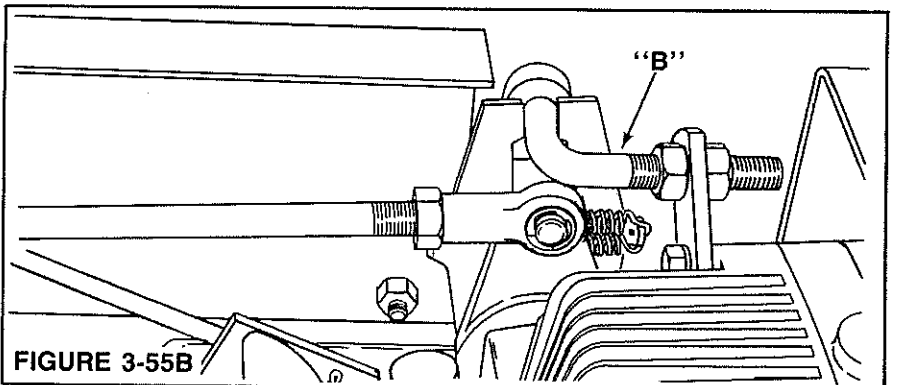
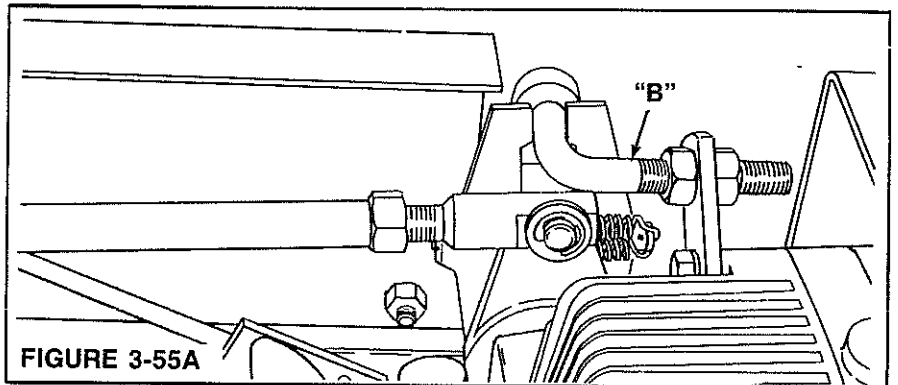
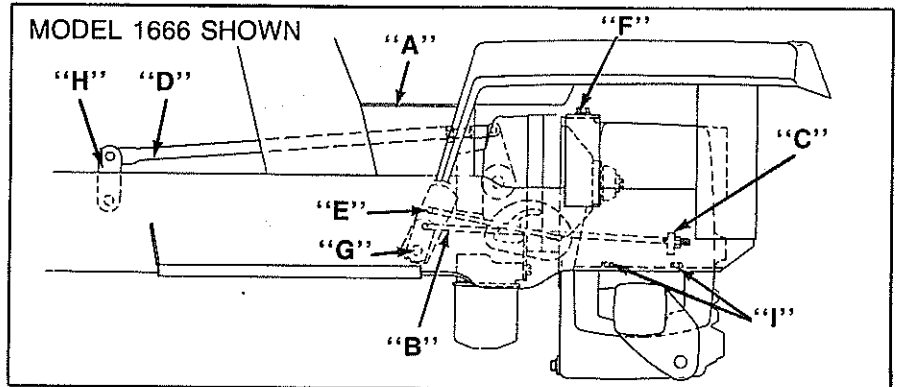
1. Position right and left hand brake rods on inside of frame rails.
2. Slowly roll transaxle between the two side frames. At the same time position the following:
  - A. Lay hydro control rod (D) over brake across shaft (G).
  - B. Direct hydro control rod (D) toward arm (H).
  - C. Lay lock plate rod (E) on top of cross shaft (G).
  - D. Slide drive shaft onto hydro shaft.
  3. Install two top transaxle mounting screws (F).
  4. Connect hydro control rod (D) to foot pedal arm with clevis pin and cotter pin.
  5. Connect lock plate arm (E) to cross shaft arm.
  6. Connect two hydraulic lines to hydro and filter.
  7. Line up transaxle to frame and install the four axle mounting screws (I). Torque to 60 ft. lbs. (81 N.m).
  8. Torque two top transaxle bolts to 23 ft. lbs. (30 N.m).
  9. Install new hydraulic fluid, 10 Qts. (9.5 liter).

**NOTE: A NEW OIL FILTER IS RECOMMENDED.**



## TRANSAXLE REINSTALLATION

10. Tighten all hydraulic fittings.
11. Check for interference around drive shaft and fan.
12. Remove spark plug or plugs from engine and motor engine for 15-20 seconds.
13. Reinstall spark plug or plugs. Start engine and run at low RPM. Actuate lift system.
14. Block up rear wheels. Restart engine; press pedal forward, reverse, then back to Neutral. If wheels continue to creep forward when in Neutral, shorten adjusting rod (B) Figure 3-55A or 3-55B, until wheels stop. Lengthen adjusting rod if wheels creep backwards.
15. Recheck transaxle fluid level. Add if necessary.
16. Secure tunnel (A) Figure 3-54, in place
17. Position the fender in place and connect the two wires to the seat switch and secure fender. See Figure 3-55C for seat switch connection.
18. Reinstall the seat.



# DRIVE TRAIN (Continued)

## TRANSAXLE REINSTALLATION

### SUNDSTRAND HYDRO MODELS

1. Set transaxle back up into normal position. Place foot on implement hitch or place a 3/4" bar into implement hitch-pin hole and begin rolling assembly into tractor frame.
2. Lay the Right and Left hand brake rods on inside frame ledge.
3. Lay travel pedal control rod over brake cross shaft and aim rod toward travel pedal arm clevis.
4. Be sure "Quadrant to brake cross shaft" link is led up over brake cross shaft.
5. Balancing transaxle (with bar in hitch or foot on hitch) roll unit on in to engage driveline to hydro input shaft.
6. Match one of the two top transaxle mounting holes with drift punch through front bracket. Start capscrews and turn in fingertight.
7. Install treadle control rod clevis pin. Hook up quadrant link to brake cross shaft and secure with cotter key.
8. Line up transaxle with frame, install the 4 axle housing capscrews. Torque to 60 ft. lbs.
9. Reinstall Right and Left brake arm extensions and readjust brakes.
10. Slide driveshaft onto hydro input shaft until hole lines up on engine crankshaft. Install bolt and nut and tighten. Tighten set screw. Check for 1/8" clearance between drive shaft and hydrostatic. Shims may be added between engine out-

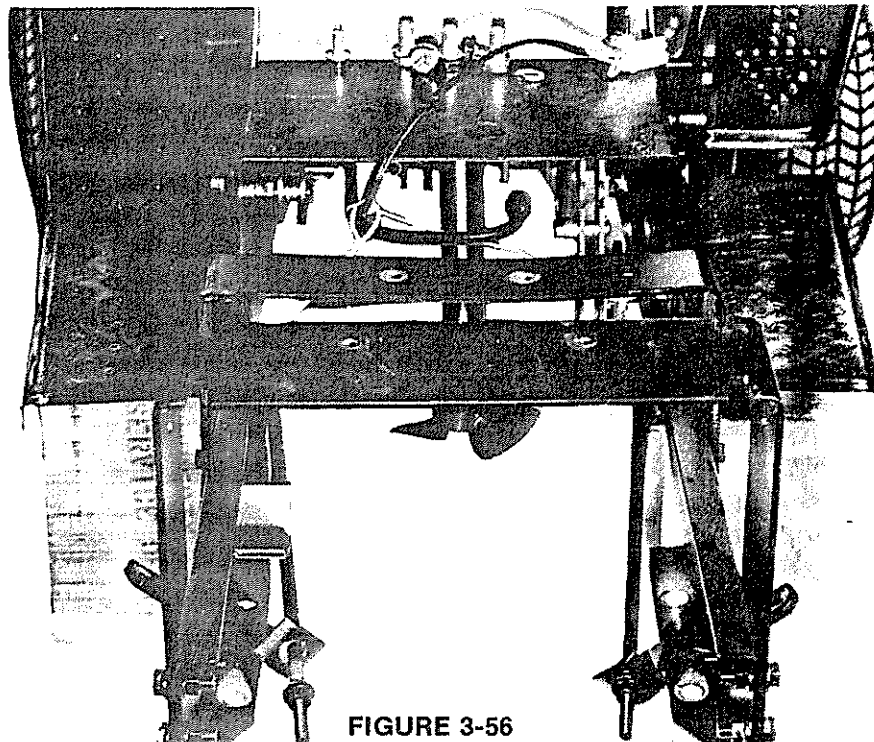


FIGURE 3-56

- put shaft and flywheel to achieve 1/8" (3 mm) clearance. Adjust engine mounts if necessary.
11. Fill a new **Bolens** oil filter with hydrostatic fluid (type "F"). Grease filter "O" ring and install hand tight only.
12. Fill transaxle assembly with approximately 10 quarts (9.46 liter) of new hydrostatic fluid.
13. Loosen pick-up tube line at hydro end, until fluid leaks out. Retighten.
14. Remove spark plug or plugs from engine and motor engine for 15 - 20 seconds.
15. Reinstall spark plug or plugs. Start engine and run at low RPM. Actuate lift system.
16. Block up rear wheels. Restart engine; press pedal forward, reverse, then back to Neutral. If wheels continue to creep forward when in Neutral, shorten adjusting rod (C) Figure 3-57, until wheels stop. Lengthen adjusting rod if wheels creep backwards.
17. Recheck transaxle fluid level. Add if necessary.

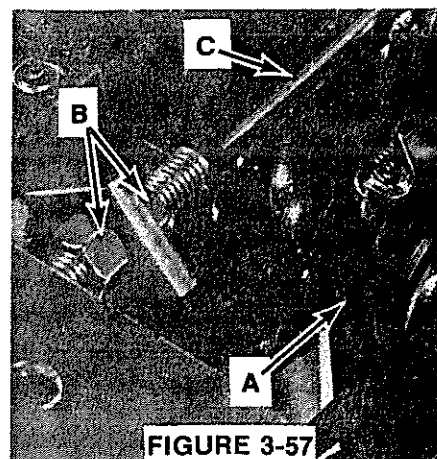


FIGURE 3-57

## GROUP IV. FUEL SYSTEM

QS, QT & 1900 SERIES  
Page 4-1 REV. 12/78

### TROUBLE SHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	REMEDY
Hard starting	<ol style="list-style-type: none"><li>1. Fuel shut off valve closed</li><li>2. Choke linkage not working properly</li><li>3. Dirt in fuel system</li><li>4. Engine flooded</li><li>5. Carburetor out of adjustment</li><li>6. Water in fuel system</li><li>7. Dirty air filter</li></ol>	<ol style="list-style-type: none"><li>1. Open valve</li><li>2. Check linkage and repair</li><li>3. Clean fuel lines, carburetor, and install new fuel filter</li><li>4. Check linkage, carburetor float setting etc.</li><li>5. Adjust carburetor</li><li>6. Clean system and refill with clean fuel</li><li>7. Install new air filter</li></ol>
No fuel reaches carburetor	<ol style="list-style-type: none"><li>1. Empty fuel tank</li><li>2. Fuel filter plugged</li><li>3. Gas tank vent plugged</li></ol>	<ol style="list-style-type: none"><li>1. Refill tank</li><li>2. Clean or replace fuel filter</li><li>3. Clean out vent</li></ol>
Carburetor leaks	<ol style="list-style-type: none"><li>1. Loose fuel line fitting</li><li>2. Carb float setting set too high</li></ol>	<ol style="list-style-type: none"><li>1. Tighten fuel line</li><li>2. Adjust float</li></ol>
Engine starts but runs rough with low power output	<ol style="list-style-type: none"><li>1. High or low speed mixture adjustments off</li><li>2. Incorrect float setting</li><li>3. Dirty air filter</li><li>4. Carburetor loose on engine block</li></ol>	<ol style="list-style-type: none"><li>1. Readjust carburetor</li><li>2. Adjust float</li><li>3. Install new air filter</li><li>4. Tighten carburetor mounting screws</li></ol>

4

## FUEL SYSTEM (Continued)

### SERVICING

#### TYPICAL FUEL FLOW DIAGRAM

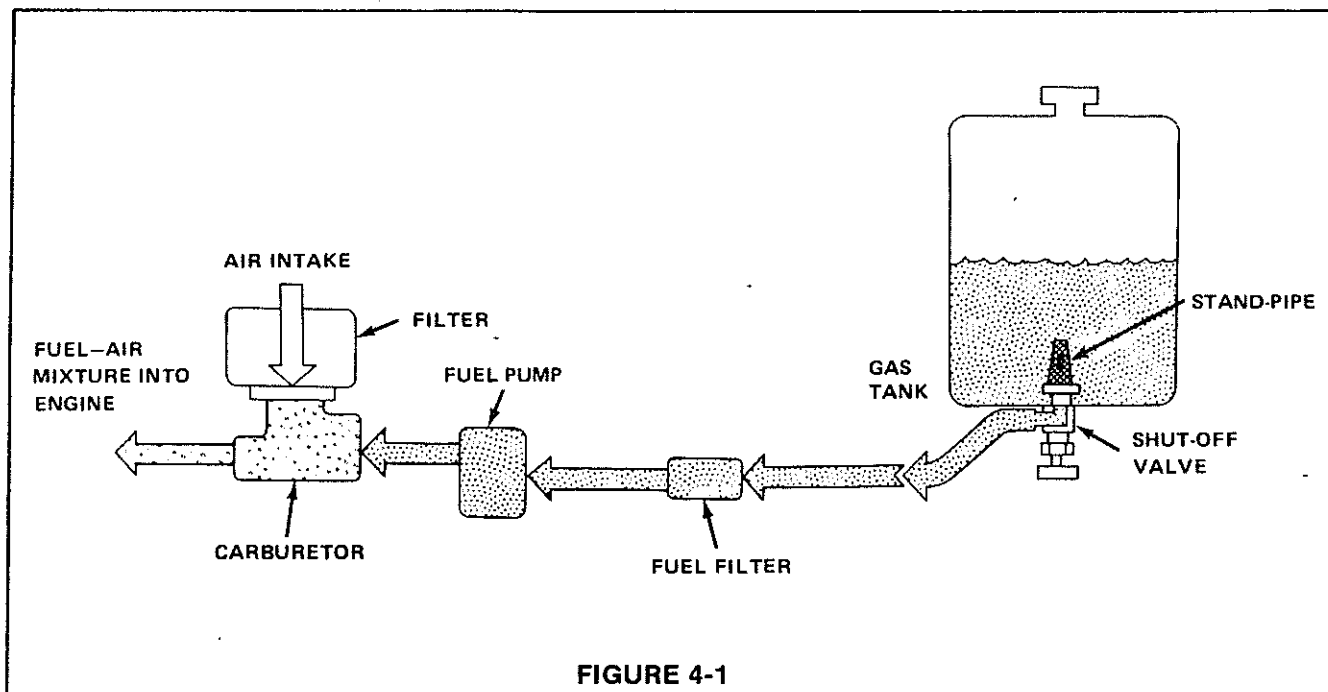


FIGURE 4-1

#### FUEL TANK

Fill with clean fresh gasoline of regular grade. (For cold weather operation use winter blend gasoline.) DO NOT MIX OIL WITH GASOLINE. REFUEL OUTDOORS WITH ENGINE STOPPED AND COOL.

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

#### FUEL VALVE

The fuel valve is located under the fuel tank as shown in Figure 4-1. This valve must be fully open for proper operation of the tractor.

#### FUEL FILTER (Figure 4-2)

Remove and replace when dirty. Filter shape may change with different models.

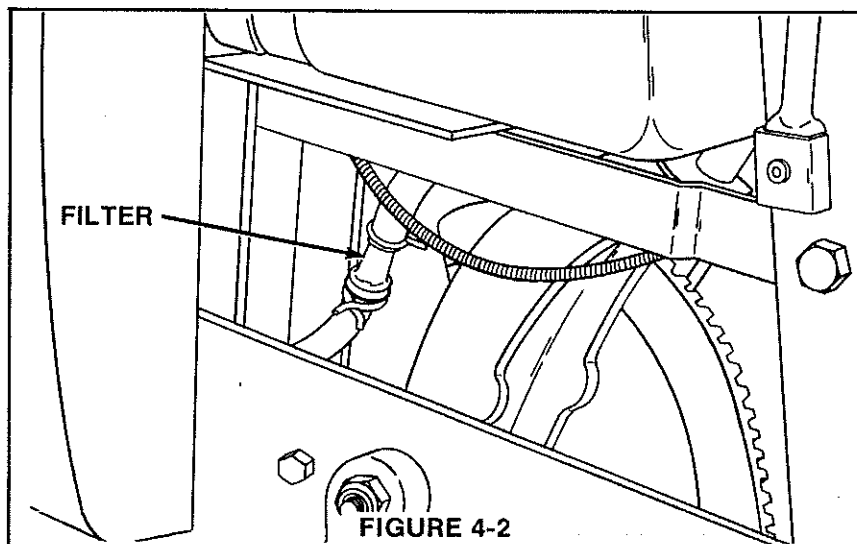


FIGURE 4-2

## FUEL SYSTEM (Continued)

QS, QT & 1900 SERIES  
TRACTORS  
Page 4-3 REV. 4/83

### AIR CLEANER

Under normal operating conditions, disassemble and service air cleaner components every 50 hours of operation. Do this more frequently (even daily) if extremely dusty or dirty conditions prevail. The dry type paper element is cleaned by gently tapping on a flat surface - when doing this, be careful not to damage gasket surfaces on element. DO NOT attempt to clean dry type paper element in any liquid or with compressed air as this will damage the paper filter material. Wipe dirt or dust accumulation from cover including base plate where used.

On Models 1966 service Precleaner, Figure 4-6B, every 25 hours or more often under extreme dirty 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.

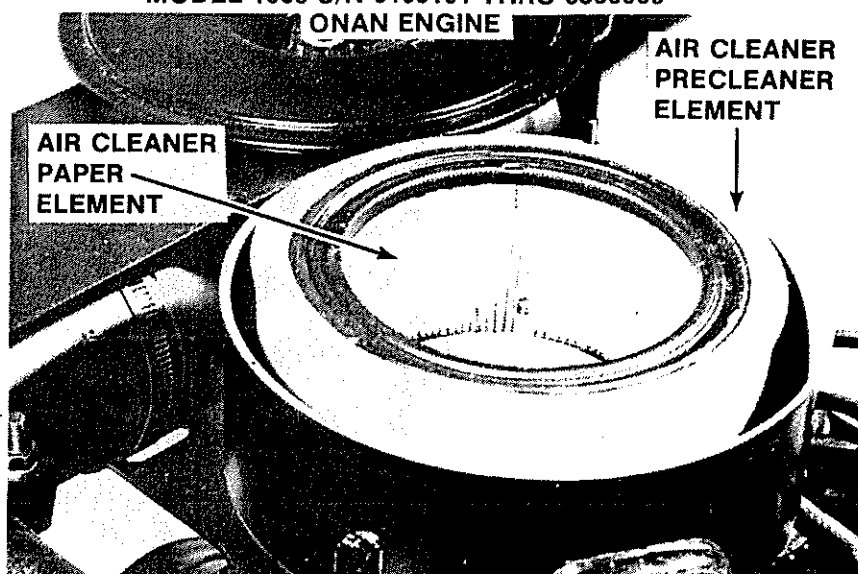
Saturate foam pre-cleaner in engine oil. Squeeze to distribute and remove excess oil.

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

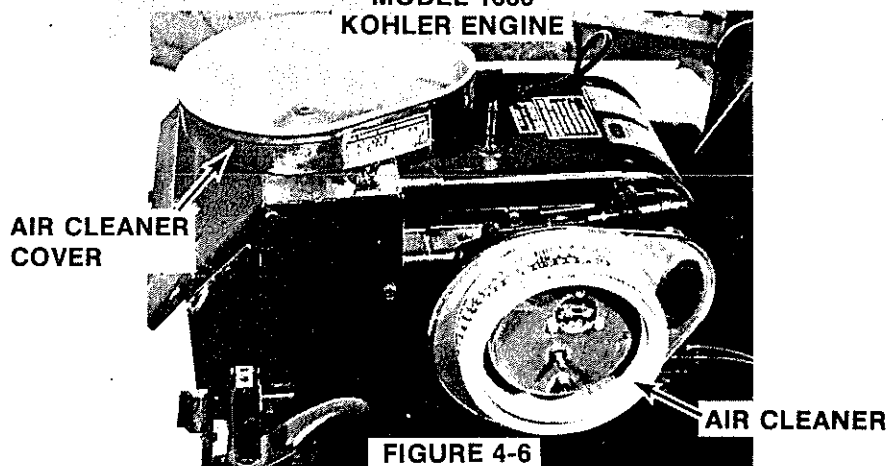
**IMPORTANT:**  
**DRY TYPE PAPER ELEMENTS**  
**SHOULD BE REPLACED AFTER**  
**200 HOURS - REPLACE AT 100**  
**HOURS IF ENGINE IS OPER-**  
**ATED UNDER DIRTY CONDI-**  
**TIONS.**

MODEL 1666 S/N 0100101 THRU 0599999

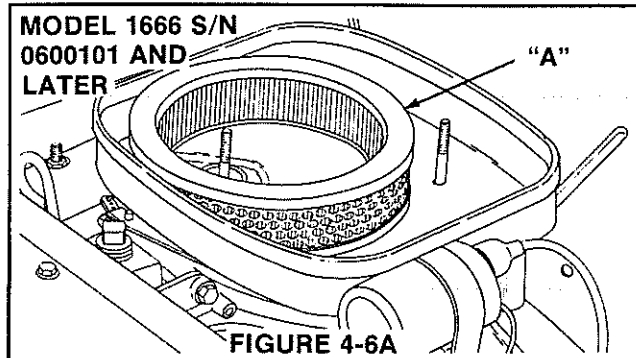
ONAN ENGINE



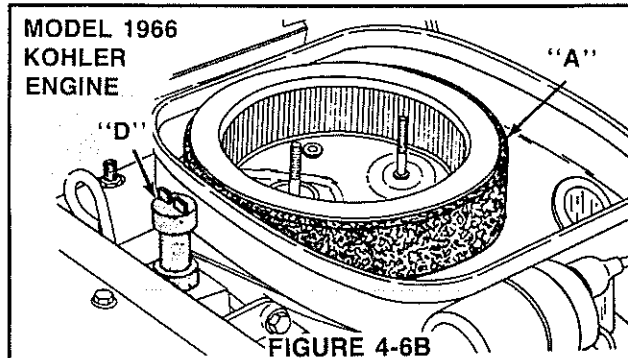
MODEL 1660  
KOHLER ENGINE



MODEL 1666 S/N  
0600101 AND  
LATER



MODEL 1666  
KOHLER  
ENGINE



4

## FUEL SYSTEM (Continued)

## SERVICING

## CARBURETOR ADJUSTMENT

ONAN ENGINE  
MODEL 1666 S/N 0100101  
THRU 0599999

The carburetor has a main fuel (high speed) adjustment and an idle fuel adjustment. The main adjustment affects operation under high engine speed conditions. Idle adjustment affects operation at idle or low speed conditions. Under normal circumstances, factory carburetor adjustments should not be disturbed. If the adjustments have been disturbed, turn needles off their seats 1 to 1-1/8 turns to permit starting. Then, readjust them for smooth operation. Engine idle speed 1900 RPM.

**NOTE:**

**BAFFLE MUST BE REMOVED TO ADJUST CARBURETOR.**

**CAUTION:**

**FORCING THE NEEDLE AGAINST ITS SEAT WILL DAMAGE IT. THE NEEDLE DOES NOT COMPLETELY SHUT OFF FUEL WHEN TURNED FULLY IN.**

Before final adjustment, allow the engine to warm up. Make the idle adjustment under no load. Set the engine idle speed at 1900 RPM. Open the main jet until the engine runs smooth under acceleration with no load. Slightly more fuel may be needed (open about 1/4 turn further) when sudden load is applied.

Set the throttle stop screw (located on carburetor throttle lever) with no load connected and while running at a low speed setting. Turn the screw to give approximately 1/32 inch (0.8 mm) clearance between the screw and pin at idle.

If engine develops a "hunting" condition (alternate increase and decrease of engine speed), try correcting by opening the main adjusting needle a little more. Do not open more than 1/2 turn beyond the maximum point of power.

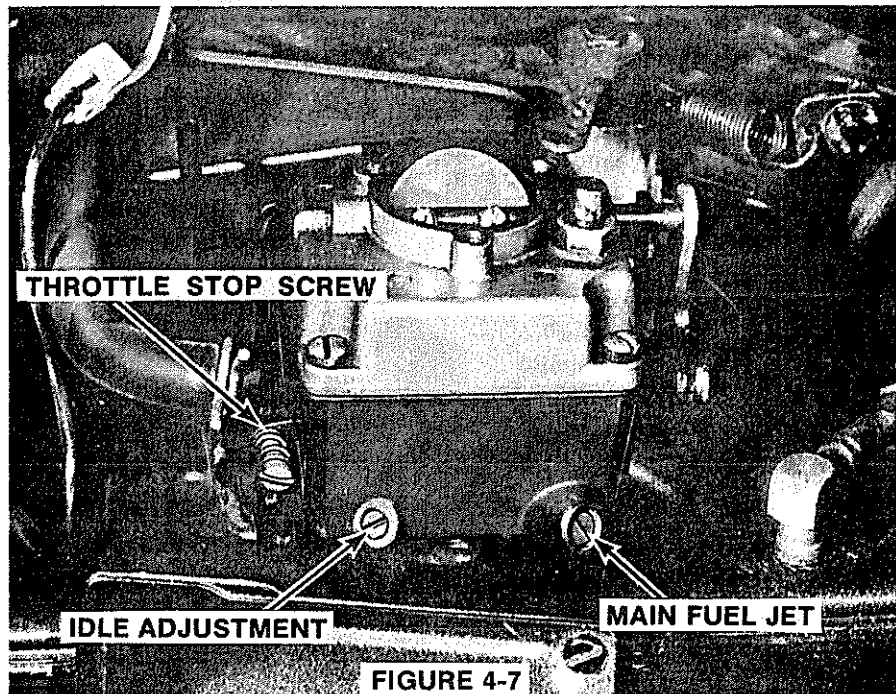


FIGURE 4-7

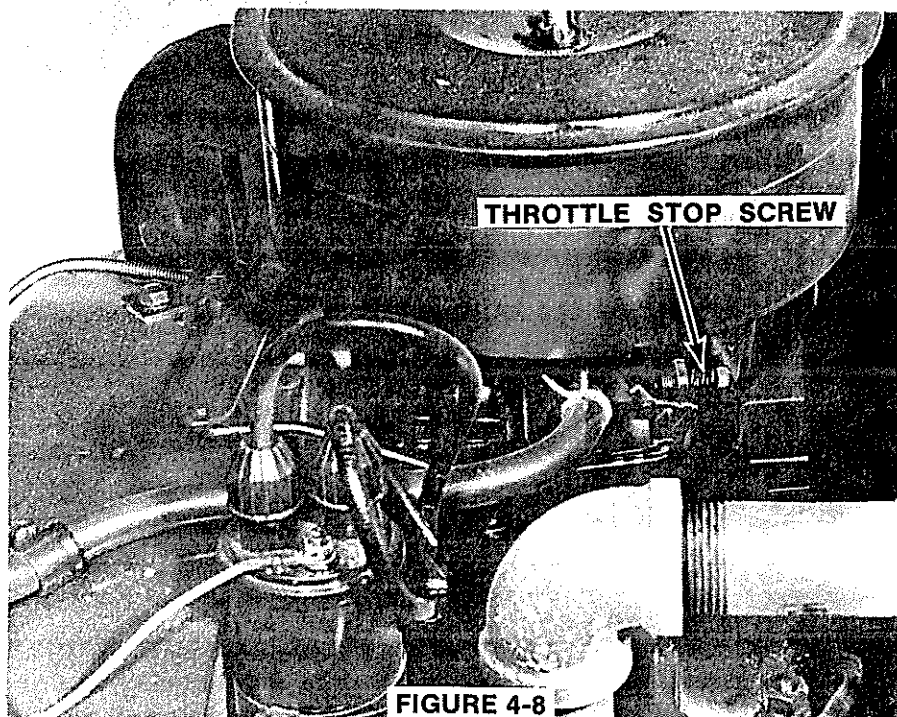


FIGURE 4-8

## SERVICING

### CARBURETOR ADJUSTMENT

KOHLER ENGINE  
MODEL 1660

The carburetor has a main fuel (high speed) adjustment and idle fuel adjustment. The main adjustment affects operation under high engine speed conditions. Idle adjustment affects operation at idle or low speed conditions. Under normal circumstances, factory carburetor adjustments should not be disturbed. If adjustments have been disturbed adjust carburetor as follows:

Turn the "MAIN FUEL" needle in (clockwise) until it bottoms lightly (DO NOT FORCE), then back-out 2 turns. With the engine thoroughly warmed up and running at full throttle (and full load if possible), turn "MAIN FUEL" screw in until engine slows down (lean setting). Back screw out until engine regains speed and then slows down again (overrich setting). Turn screw back in until it is positioned half-way between lean and overrich settings. When properly adjusted, engine will accelerate smoothly and operate steady. Turn "Idle Fuel Screw" clockwise until it bottoms lightly (DO NOT FORCE) then back out 1/2 to 3/4 turn. Restart engine and loosen hex nut "A", see figure 4-10, turn solenoid "B" in or out of bracket "C" until idle speed of 2350 RPM is achieved. Retighten nut "A". Run engine at full throttle for about 5 minutes, let engine idle for about 1 minute, then shut engine off. If engine diesels, recheck above adjustments.

**FORCING THE NEEDLE AGAINST ITS SEAT WILL DAMAGE IT. THE NEEDLE DOES NOT COMPLETELY SHUT OFF FUEL WHEN TURNED FULLY IN.**

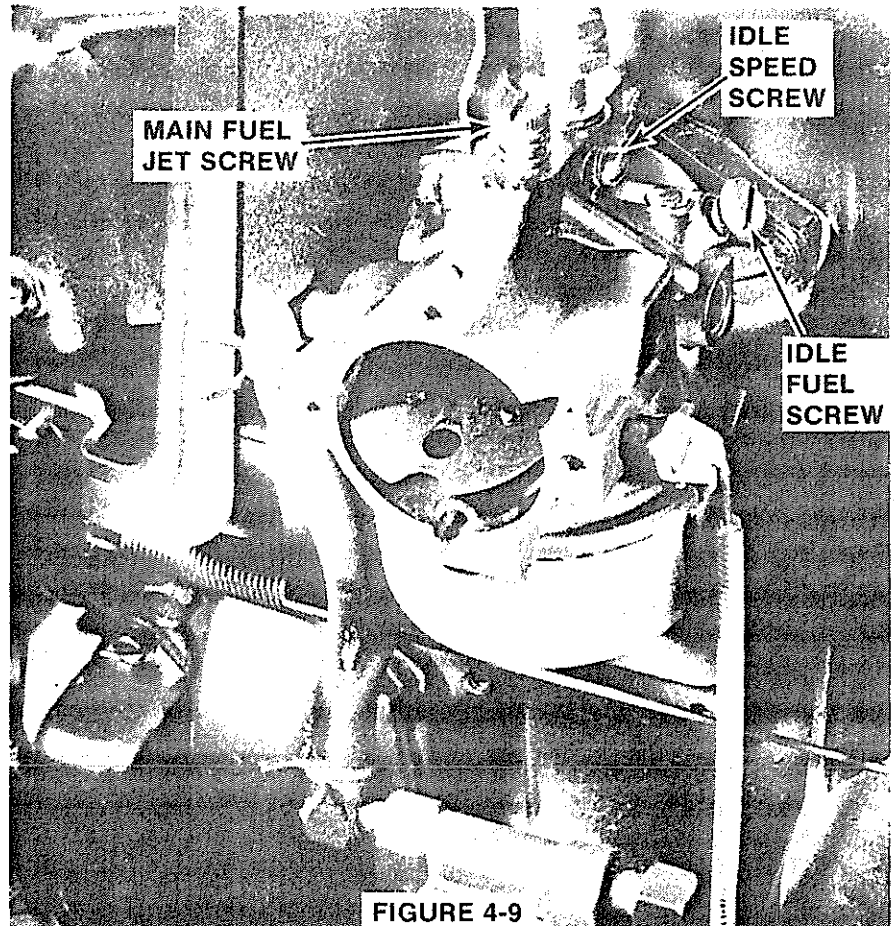


FIGURE 4-9

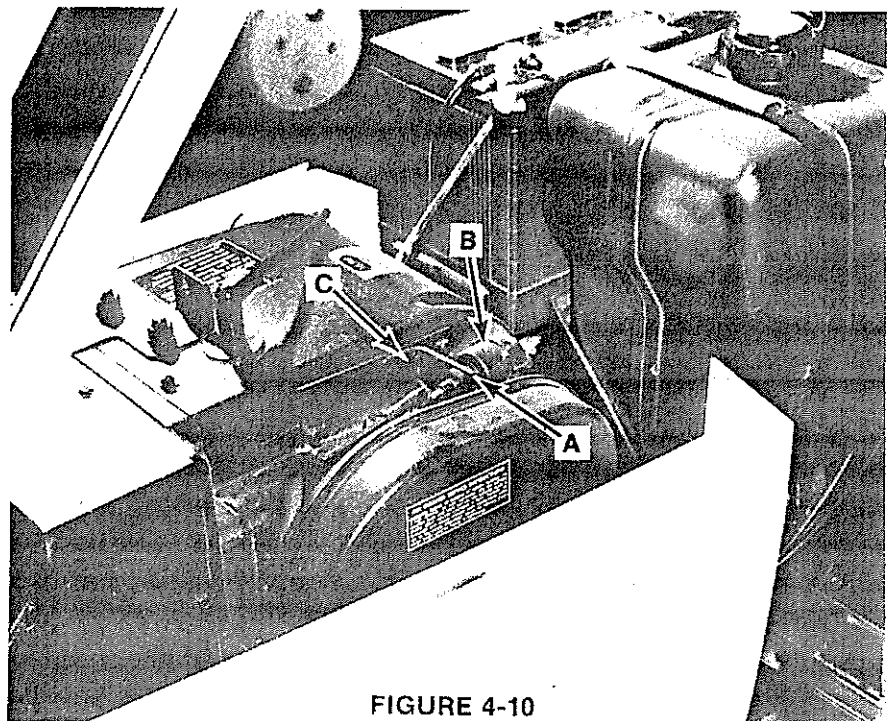


FIGURE 4-10



## FUEL SYSTEM (Continued)

### SERVICING

#### CARBURETOR MODELS 1966 AND 1666 S/N 0600101 AND LATER KOHLER ENGINE

The carburetor has a MAIN fuel (high speed) adjustment (A) and an IDLE fuel adjustment (B). The main adjustment affects operation under high engine speed conditions. Idle adjustment affects operation at idle or low speed conditions. Under normal circumstances, factory carburetor adjustments should not be disturbed. If adjustments have been disturbed adjust carburetor as follows:

Turn the "MAIN FUEL" screw (A) and IDLE fuel screw (B) in (clockwise) until it bottoms lightly (DO NOT FORCE).



#### CAUTION

**FORCING THE NEEDLE AGAINST ITS SEAT WILL DAMAGE IT. THE NEEDLE DOES NOT COMPLETELY SHUT OFF FUEL WHEN TURNED FULLY IN.**

For preliminary setting back out Main fuel screw (A) 2-1/2 turns and IDLE fuel screw 1-1/4 turns. With the engine thoroughly warmed up and running at full throttle (and full load is possible), turn "MAIN FUEL" screw in until engine slows down (lean setting). Back screw out until engine regains speed and then slows down again (overrich setting). Turn screw back in until it is positioned halfway between lean and overrich settings. When properly adjusted, engine will accelerate smoothly and operate steady. Adjust the IDLE fuel screw (B), in the same manner for smoothest idle. Rough idle is often due to idle speed screw (C) being set too low. Check this also.

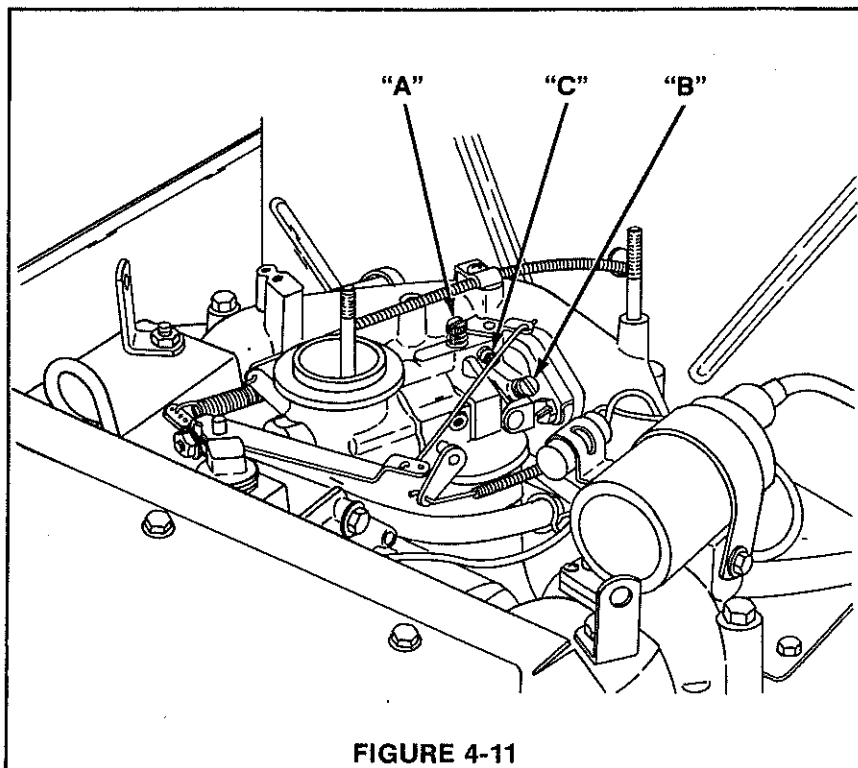


FIGURE 4-11



## GROUP V. CHASSIS

QS, QT & 1900 SERIES  
TRACTORS  
Page 5-1 REV. 4/83

### STEERING ASSEMBLY

#### LEGEND FRONT AXLE ASSEMBLY

1. Front Axle
2. Tie Rod
3. L.H. Hand Ball Joint
4. R.H. Hand Ball Joint
5. L.H. Nut - 1/2-20
6. Flange Bearing
7. R.H. Nut - 1/2-20
8. Cotter Pin
9. Woodruff Key
10. Grease Fitting
11. Spindle Assembly
12. R.H. Knuckle Arm
13. L.H. Knuckle Arm
14. Flat Washer
15. Castellated Nut - 3/8-24
16. Flat Washer
17. Lock Screw
18. Ball Joint
19. Hex Nut 5/8-18
20. Tie Rod

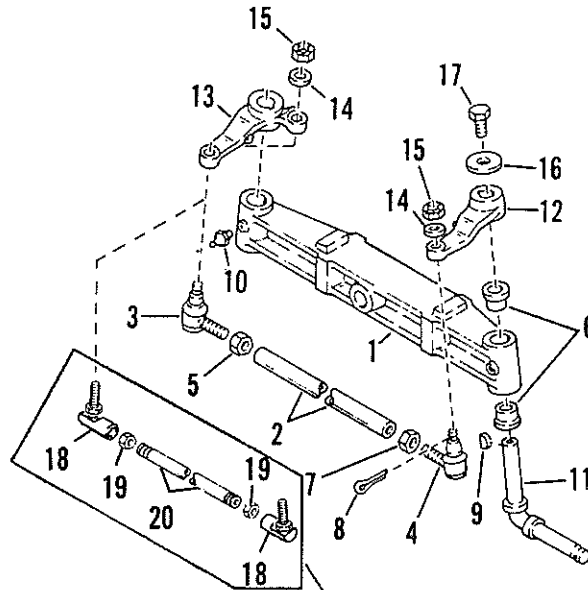


FIGURE 5-1

Model 1666 S/N 1000101 AND LATER  
Model 1966 S/N 0100101 AND LATER

#### FRONT WHEEL ALIGNMENT

1. Turn steering wheel so that front wheels are straight ahead.
2. Measure distance across front of front tires, center line to center line. Measure distance across rear of front tires, center line to center line. Reading across front of tires should be 1/8 to 3/8 inch (.3 to .9 cm) less than across the rear of tires. If adjustment is necessary loosen lock nuts on tie rod and turn tie rod in or out as required.
3. After adjustment is obtained tighten hex lock nuts securely.
4. Readjust drag link to center steering wheel.

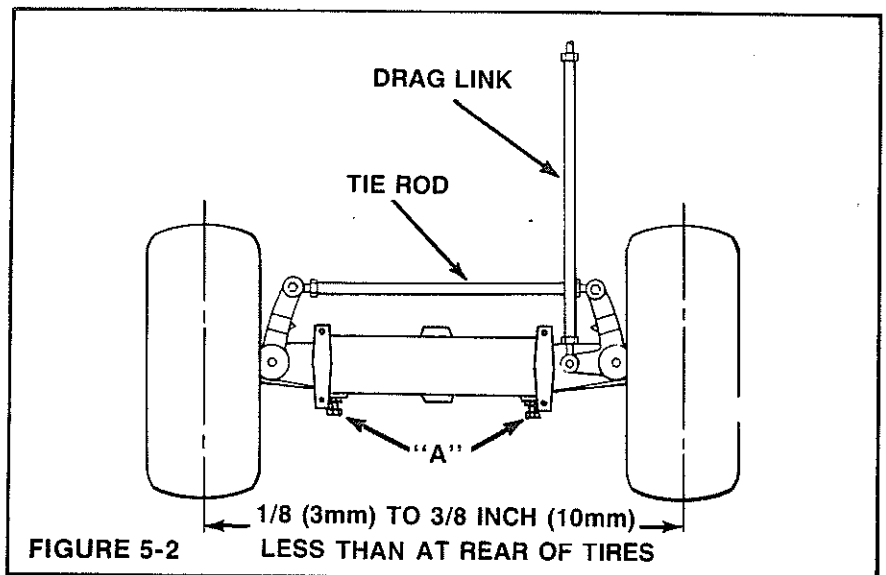


FIGURE 5-2

#### FRONT WHEEL ADJUSTMENT Models 1666 S/N 1000101 and later and 1966

An adjustment has been provided on the front axle to cut down on excessive engine vibration. By ad-

justing screws (A), Figure 5-2, 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.

## CHASSIS (Continued)

### STEERING ASSEMBLY

#### REMOVAL

1. Crank engine to move lift into down position.
2. Disconnect negative battery cable.
3. Close petcock, disconnect fuel line at filter and remove fuel tank.
4. Remove left footrest on earlier units.
5. Remove stop nut (A) Figure 5-3.
6. Remove front tie rod ball joint (B) Figure 5-4.
7. Rotate pinion gear (C) to left until sector (D) drops toward engine.
8. Slide sector gear (D) off of steering shaft (E). Some force may be needed to slide gear off.
9. Remove key from steering shaft.

**NOTE:**  
**A PUNCH CAN BE USED TO PARTIALLY REMOVE KEY.**

10. Slide steering shaft (E) out.
11. Remove washers (F) from steering support and save.
12. Disassemble steering support from frame if needed.

#### STEERING GEAR REBUILDING

Disassemble and replace bevel pinion and the 2 sector shaft bushings. Install pinion shaft in steering support casting. Slide steering shaft through support and slide on shim washers removed in step 11 above. Slide on sector gear and rotate under pinion gear. Observe back lash

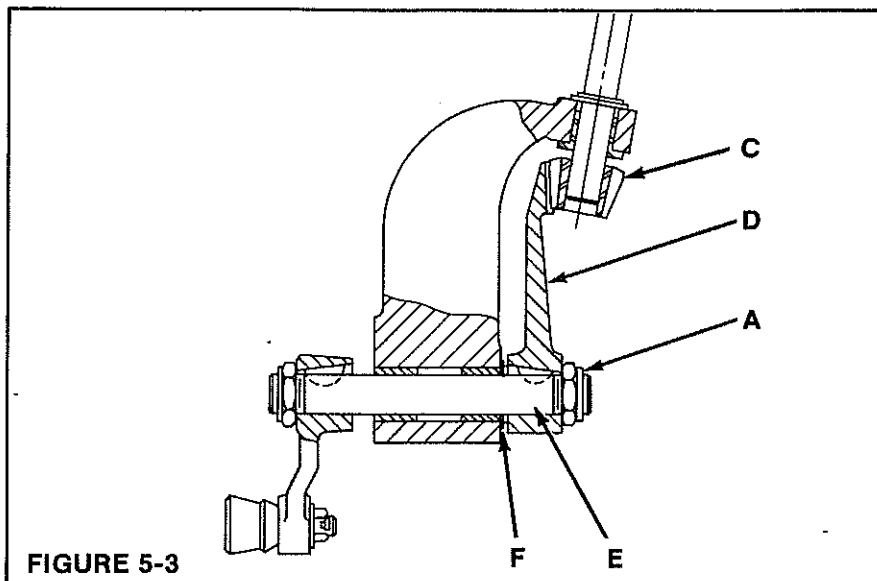


FIGURE 5-3

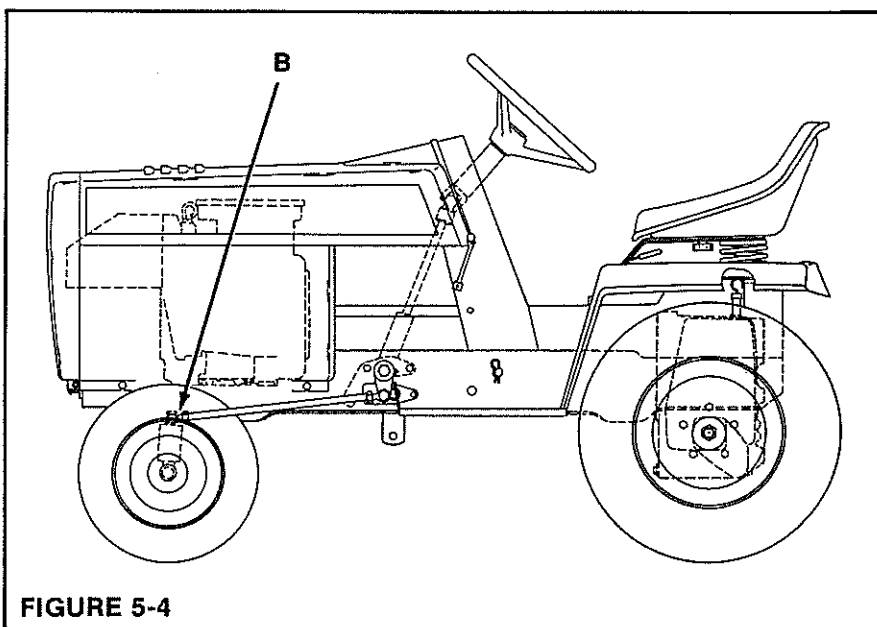


FIGURE 5-4

while rotating sector. If excessive, remove sector shaft and install nylon washer.

**NOTE:**  
**TWO NYLON WASHERS (SHIMS 1709224 (.031) AND 1725069 (0.62) ARE AVAILABLE TO OBTAIN FREE MOVEMENT THROUGH SECTOR ARC WITH MINIMUM BACKLASH.**

#### REASSEMBLY

1. Position lift in down position.
2. Fasten steering support to frame.
3. Slide steering shaft (E) through support.
4. Slide washers (F) onto steering shaft.

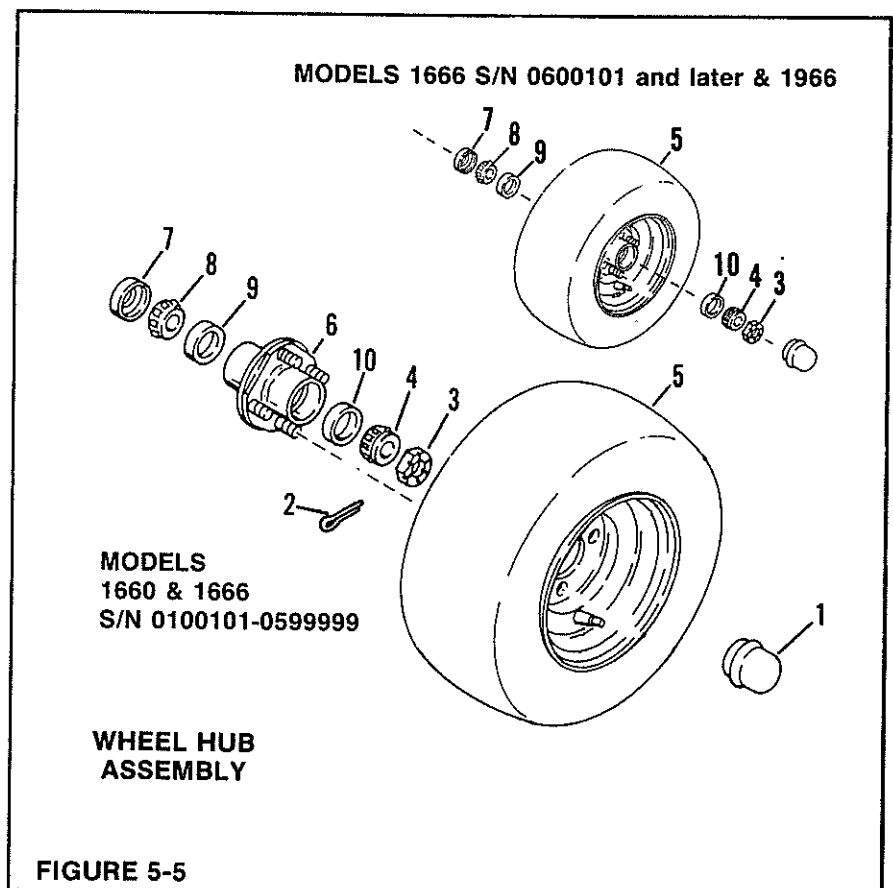
## STEERING ASSEMBLY

5. Insert key into shaft (E) and slide steering sector (D) on shaft.
6. Run stop nut (A) onto shaft and secure.
7. With the Bolens steering cap logo in its normal level reading position, place a chalk mark on pinion shaft facing you.
8. Rotate steering wheel clockwise till chalk mark is straight forward.
9. Rotate sector gear into mesh with pinion gear. Turn steering wheel to left and engage pinion. Keep rotating till pinion is in the center of sector gear (D).
10. Reinstall front ball joint (B). Ball joints on tie rod should be 19-1/4" (49 cm) apart.
6. Remove inner bearing (8) from hub.
7. Clean both inner race (9) and outer race (10). Check both for wear or pitting. Replace if necessary.
8. Clean bearings in a commercial solvent. Dry with compressed air or a clean cloth.  
**Do not spin the bearing with compressed air. Damage to the bearing could result.**
9. Pack bearings with a good grade of wheel bearing grease.
10. Install inner bearing and seal into hub.
11. Install wheel and hub assembly to spindle.
12. Install outer bearing.
13. Tighten nut until it snugs up against the outer bearing. Spin wheel to align bearings, then back nut off to nearest slot in line with hole in spindle and install new cotter pin.
14. Install dust cap.

## FRONT WHEEL BEARINGS

Front wheel bearings should be repacked at least once a year.

1. Remove the dust cap (1).
2. Remove cotter pin (2) and unscrew slotted nut (3).
3. Remove outer bearing (4).
4. (Model QS & QT S/N 0100101 THRU 0599999) Remove wheel (5) and hub assembly (6) from spindle.
5. Remove seal (7) from hub. If this seal is damaged in any way replace it.



## CHASSIS (Continued)

### STEERING ASSEMBLY

#### TRAVEL PEDAL

The travel pedal angle can be adjusted for the operator's comfort.

1. Loosen nut "A" Figure 5-6 or 5-6A.
2. Remove cotter pin from pin B or rod D. Remove pin or rod from control arm Figure 5-7 or 5-7A.
3. To bring toe of pedal closer to operator, shorten rod "C" Figure 5-6 or 5-6A.
4. To move toe of pedal farther away from operator, lengthen rod "C".
5. After desired adjustment is reached, align hole in pedal end of rod "C" with hole in control arm and secure with pin "B" or rod "D" and cotter pin. Lock hex nut "A" Figure 5-6 or 5-6A.

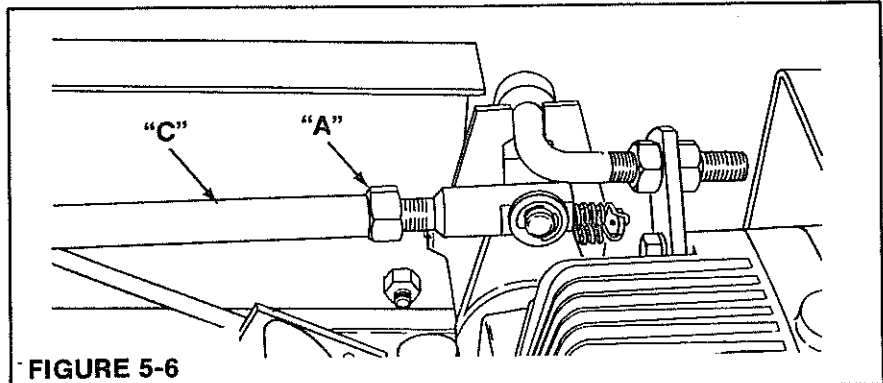


FIGURE 5-6

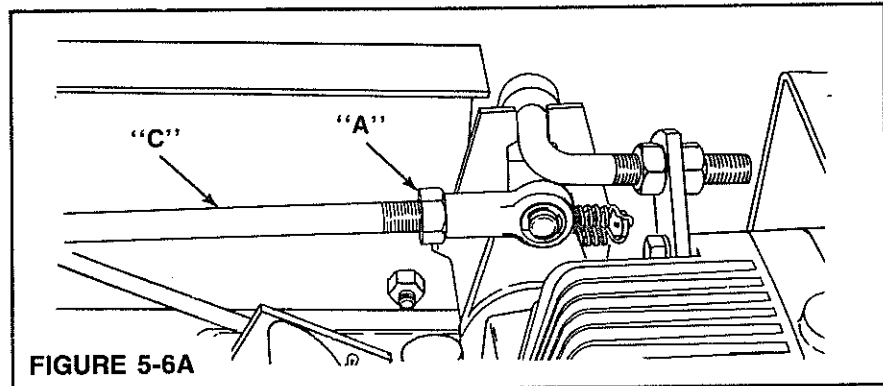


FIGURE 5-6A

#### DISC BRAKES

If the brake linkages have been disassembled for any reason readjust as follows:

The brake system on these tractors has a "Neutral" interlock built into it. When the brake pedal is depressed, pin "A" Figure 5-8 moves into slot "B" of lock plate "C" moving the transmission controls into the "Neutral" position. If the parking brakes are locked the transmission is also locked in "Neutral".

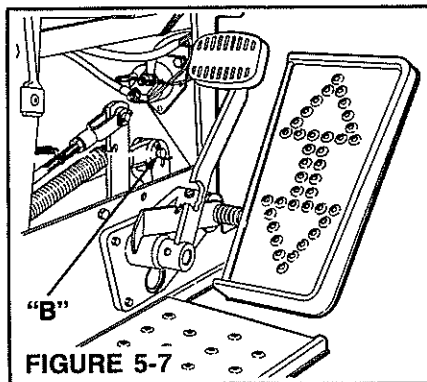


FIGURE 5-7

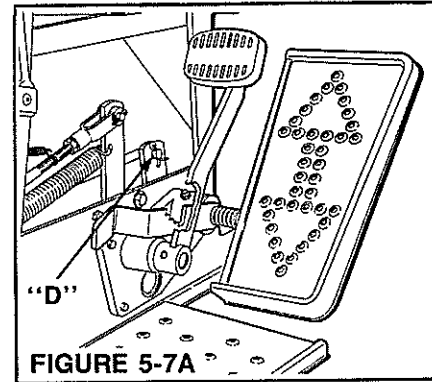


FIGURE 5-7A

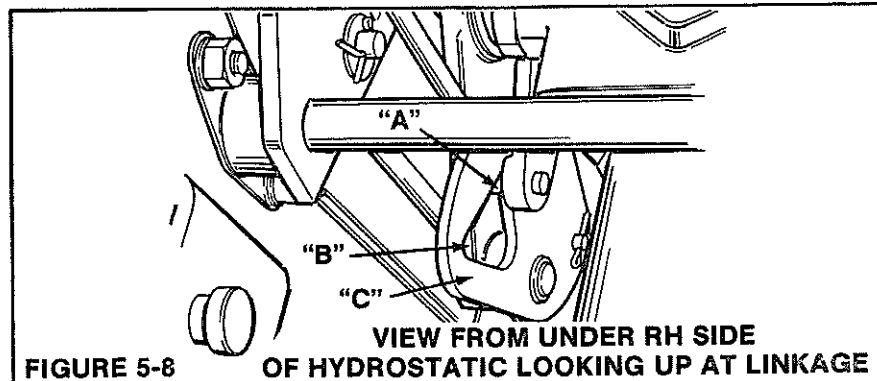


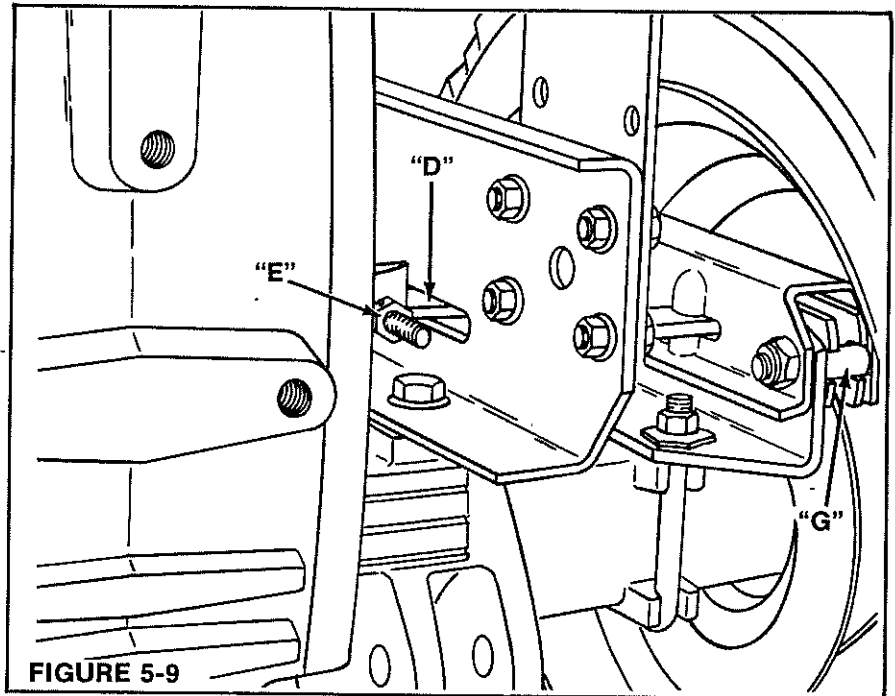
FIGURE 5-8

VIEW FROM UNDER RH SIDE  
OF HYDROSTATIC LOOKING UP AT LINKAGE

## BRAKE ASSEMBLY

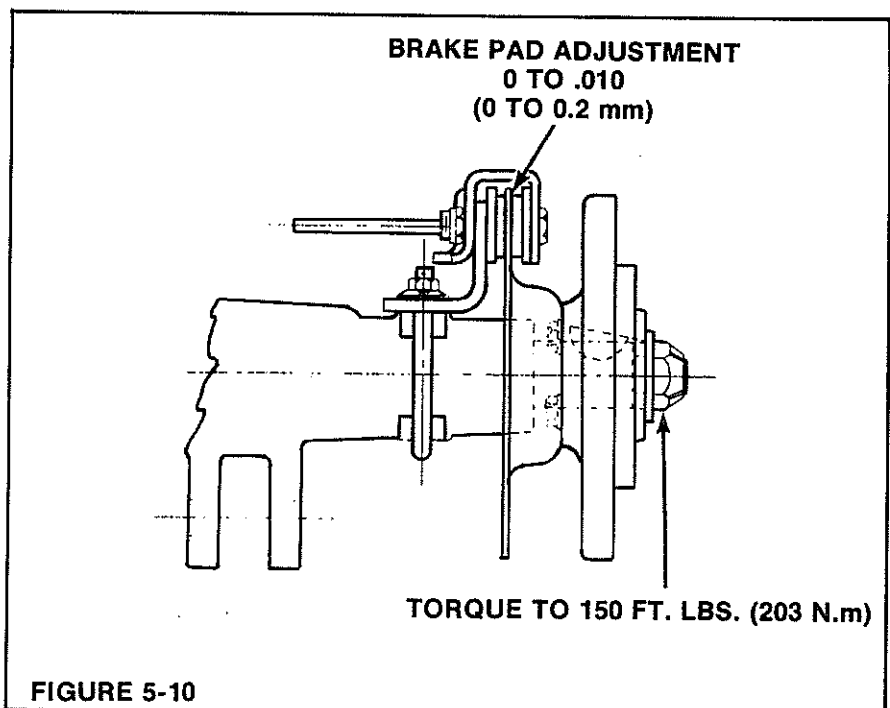
1. With the brakes fully released, and arms "D" Figure 5-9 to the rear of the slot in the tractor frame, adjust the length of arms (D) to clear center section casting of transaxle.
2. Depress brake pedal until pin "A" Figure 5-8 of control just enters slot "B" of lock plate. Lock the brake pedal in this position.
3. Move brake arms "D" Figure 5-9 forward to remove brake pad/disc clearance. Adjust nuts "E" Figure 5-9 on brake rods to contact arm extension assemblies.

**NOTE:**  
BE SURE TO ADJUST THE  
BRAKES ON BOTH WHEELS  
EQUALLY TO AVOID UNEVEN  
BRAKING. CHECK FOR  
PROPER OPERATION.



### REPLACING THE BRAKE PADS

1. Remove brake assembly "F" Figure 5-10 from tractor.
2. Remove one of the bolts "G" Figure 5-9 which hold the brake pads in the bracket.
3. The brake pads can now be removed.
4. Reverse the above procedure to reassemble.



## CHASSIS (Continued)

### INTERLOCK SWITCHES

#### INTERLOCK SWITCHES

1. One switch is on the brake linkage. To check adjustment depress brake pedal. When brake pads contact disc, pin (A) should just be in slot (B) of lever (C) Figure 5-11. If switch does not activate adjust as follows:

(Model 1666 S/N 0100101 thru 0199999)

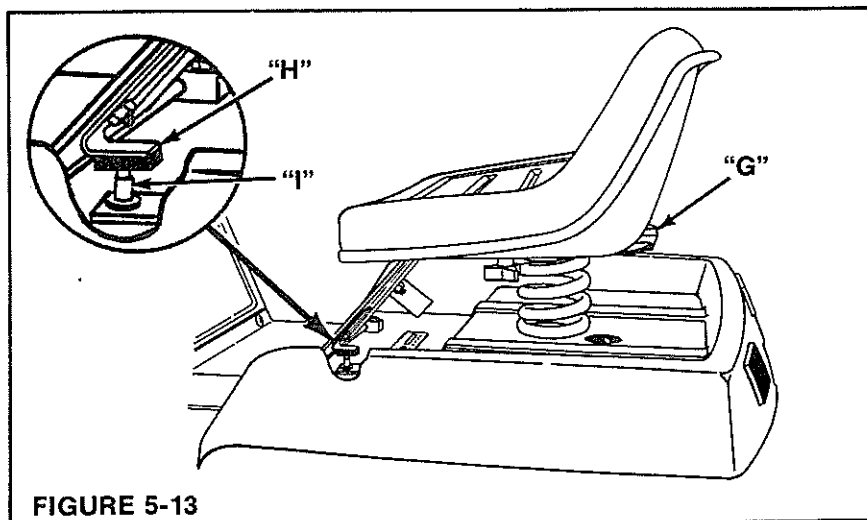
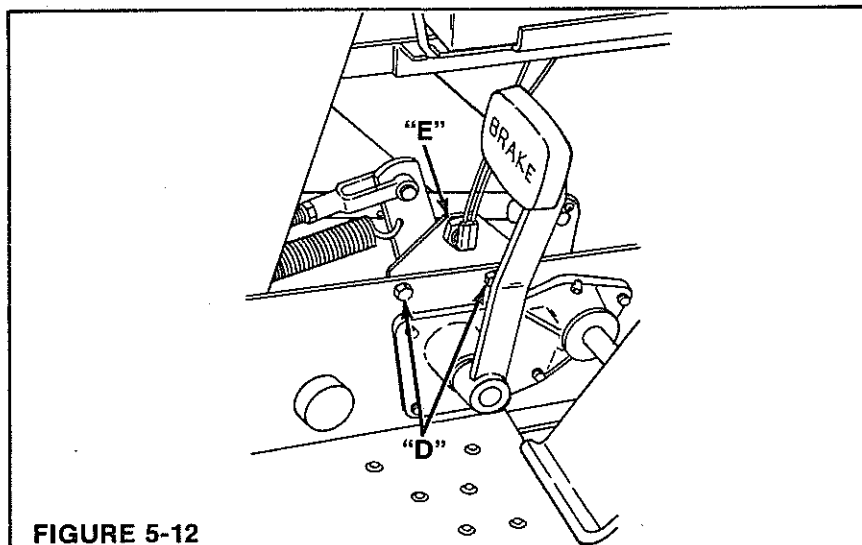
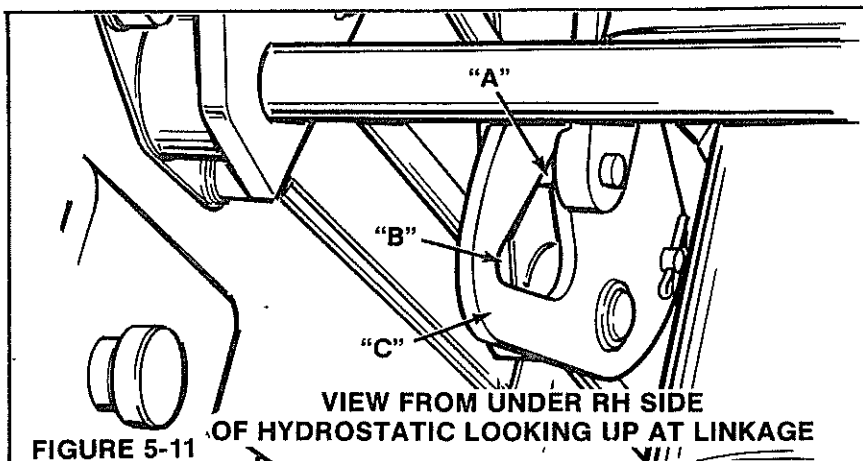
Loosen hex nuts "D" Figure 5-12 and move switch support "E" either forward or rearward until proper adjustment is obtained.

(Model 1660 & 1666 S/N 0200101 thru 0499999)

Adjust clip (F) Figure 5-14 on brake rod till switch activates.

(Models 1666 S/N 0500101 and later & 1966)

2. A seat switch is located under the seat. This switch should be activated when back edge of seat support (G) Figure 5-13 is depressed  $\frac{5}{8}$ " (1.6 cm). If not loosen bracket (H) and move to correct location. The switch can also be activated by raising the seat and lifting the interlock button (I) up.



## POWER TAKE-OFF (P.T.O.)

### MODEL 1666 (QT16)

Inside idler (not shown) Serial No's 0100101 thru 0399999, Outside idler (see figure 5-15) Serial No. 0400101 and up.

Should it become necessary to replace Attachment Drive belts, install new belts as follows:

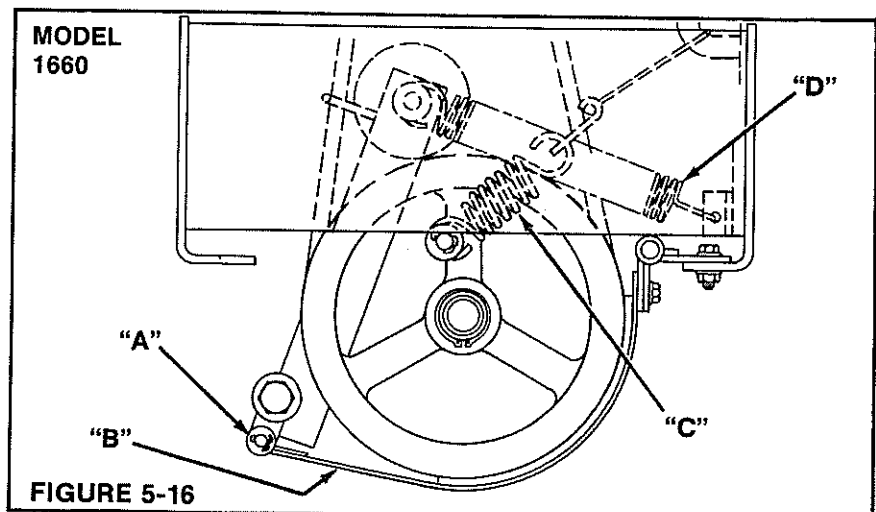
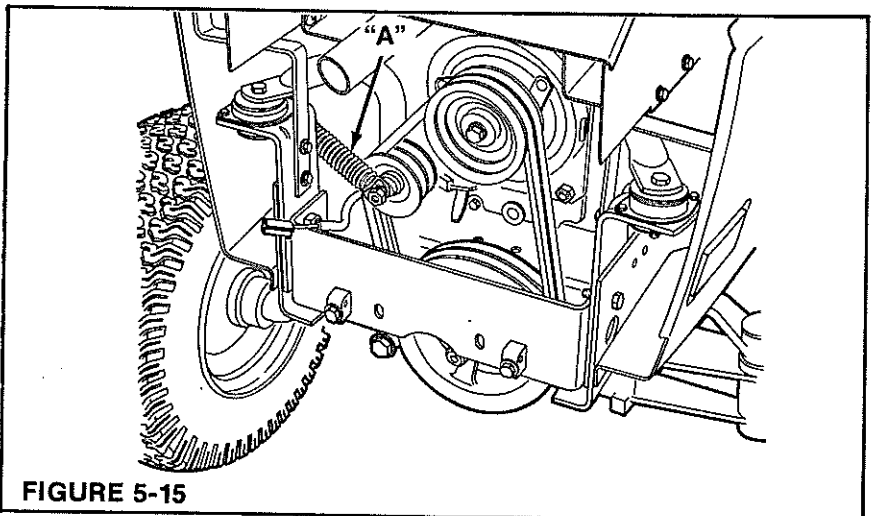
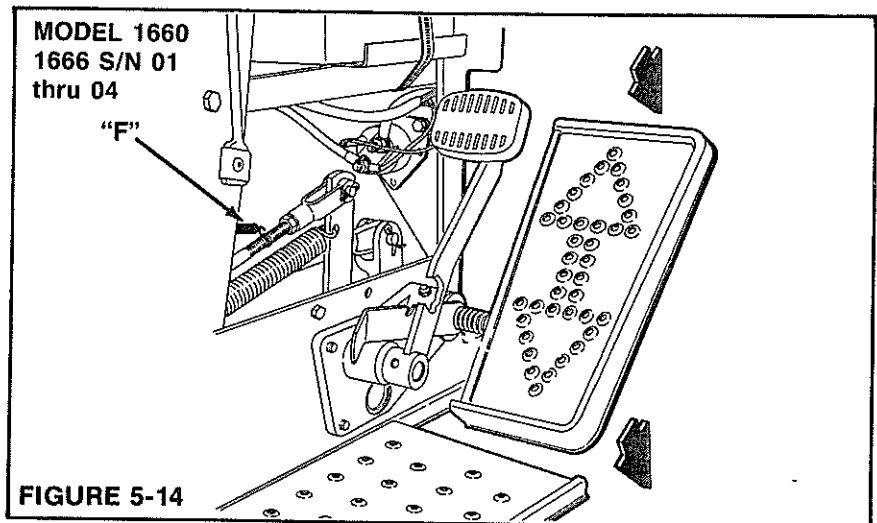
1. Place switch in OFF position.
2. Remove hood.
3. Unhook spring (A) Figure 5-5 from idler arm.
4. Remove old belts.
5. Reverse the above procedure to install the new belts.

**NOTE:**  
**SHREDDING OF BELTS IS**  
**GENERALLY CAUSED BY A MIS-**  
**ALIGNED IDLER PULLEY. IF**  
**THIS PROBLEM EXISTS, MAKE**  
**SURE IDLER IS ALIGNED BEFORE**  
**NEW BELTS ARE INSTALLED.**

### MODEL 1660 (QS-16)

Should it become necessary to replace Attachment Drive belts, install new belts as follows:

1. Remove hood.
2. Place attachment drive lever into the "On" position.
3. Remove cotter pin (A) Figure 5-16 and pin in lower brake shoe pivot and drop shoe. (B).
4. Place attachment drive lever into the "Off" position.
5. Remove spring (C) and cable for attachment drive control.

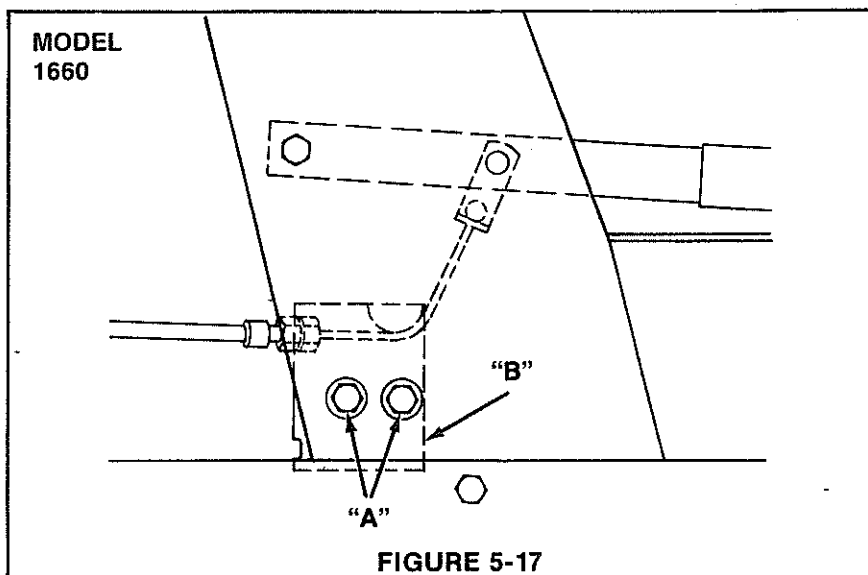


## CHASSIS (Continued)

### POWER TAKE-OFF (P.T.O.)

6. Remove idler spring (D).
7. Remove old belts.
8. Reverse above procedure to install new belts.

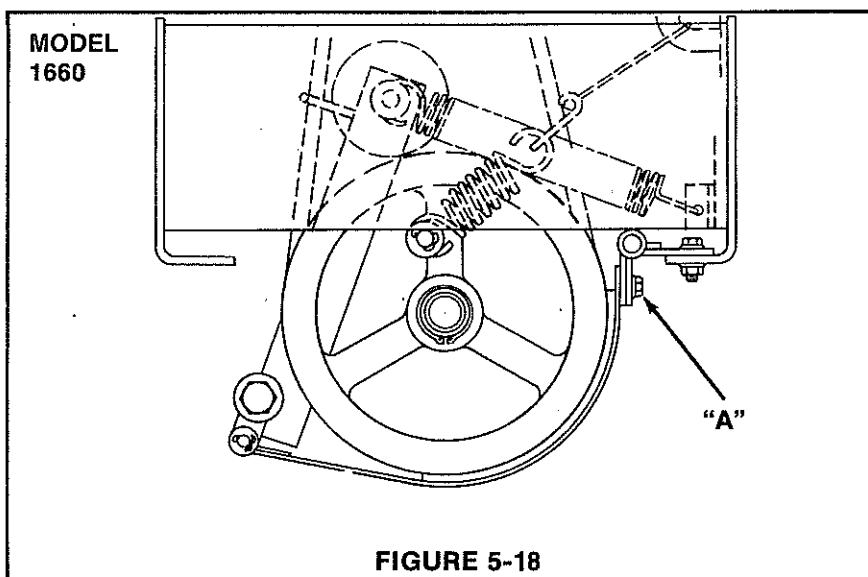
**NOTE:**  
IF THE P.T.O. BRAKE ADJUSTMENT HAS BEEN DISTURBED WHILE REPLACING THE BELTS READJUST AS SHOWN.



#### CABLE ADJUSTMENT

Should the belts on the attachment drive slip adjust as follows:

1. Loosen the two capscrews "A" Figure 5-17 on the Left side of the tractor console.
2. Move bracket "B" down in slots.
3. Test control for proper belt tension.



#### BRAKE SHOE ADJUSTMENT MODEL 1660 (QS-16)

Should the Attachment Drive Brake need adjustment proceed as follows:

1. Loosen two hex nuts and capscrews "A" Figure 5-18.
2. Move brake shoe up in slots until there is .012 inch clearance between the brake shoe and the rim of the Attachment Drive Sheave.

#### ATTACHMENT DRIVE BRAKE ADJUSTMENT MODEL 1666 (QT-16 & QT-17) & 1966

##### REMOVAL

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

Disconnect polarized plug (A) Figure 5-19 from clutch.

Remove four locknuts (B) and remove brake plate mounting.

Remove mounting bolt from center of crankshaft.

Remove sheave and armature assembly.

Remove rotor assembly.



### POWER TAKE-OFF (P.T.O.)

Remove four 10-32 x 1/2 socket head capscrews and lockwashers securing coil assembly to crankcase.

Remove coil assembly from engine.

#### INSTALLATION

Position coil assembly on engine piloting in crank-shaft seal bore. Secure with four 10-32 x 1/2 socket capscrews and lockwashers.

Install the four brake mounting studs into engine block.

Place compression springs on brake mounting studs.

Remove rust, burrs and dirt from engine shaft with sandpaper.

Apply light coat of grease or oil to shaft.

Insert key into keyway in shaft.

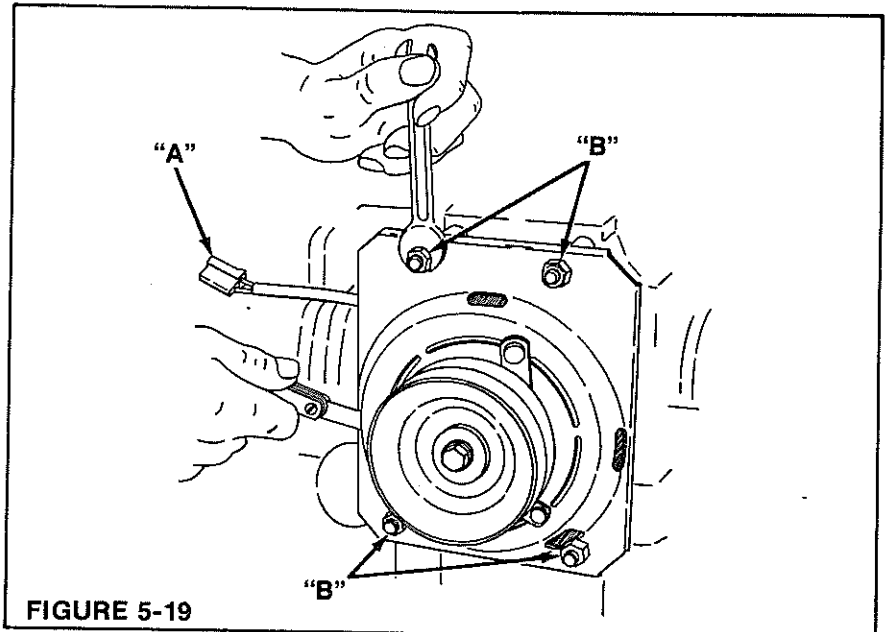
Push rotor and armature assembly with pulley onto engine shaft until hub bottoms on crankshaft shoulder.

Place plain washer and lockwasher on clutch mounting capscrew.

Install capscrew into tapped hole in center of crankshaft. Hold clutch from rotating, while tightening capscrew.

Adjust brake as described under maintenance.

Reconnect coil assembly lead to lead from switch making certain connection is secure and wire is not rubbing against rotating parts.



#### MAINTENANCE

Once the clutch/brake has been installed, the clutch portion requires no further maintenance. The unit is self-adjusting for wear and never requires lubrication.

The brake portion may require readjustment periodically depending upon unit usage. This can be accomplished as follows:

Position a .015" (0.38 mm) thick shim in each slot provided (4) in brake flange and turn on clutch/brake.

Push on the brake flange until it bottoms out. Tighten the (4) locknuts until they just contact brake flange. (**CAUTION:** Do not over torque locknuts as damage to brake flange may result).

Turn clutch/brake off and remove (4) shims. Recheck gap through the slots provided. A minimum of .010" (0.25 mm) and a maximum of .020" (0.51 mm) should be maintained.

If oil or grease contaminate clutch working surfaces, remove with a cleaning fluid such as barcothene. Alcohol or ammonia are acceptable substitutes. With engine off, pour a generous quantity of cleaning fluid between working surfaces.

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

- Position gearshift in neutral position.
- Start tractor engine, and put throttle in fast position.
- 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.

## CHASSIS (Continued)

### POWER TAKE-OFF (P.T.O.)

#### TROUBLESHOOTING

Check wiring system for an intermittent break or poor electrical connection.

#### Electrical Data -

See wiring diagram in the electrical section of this manual.

- a. Clutch does not engage - Check electrical system for broken wires or bad connections.

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 air gap. This is done by inserting a feeler gauge in the (4) slots provided in the brake flange. The gap should be between .010" - .020" (0.25 - 0.51 mm) with the clutch/brake switch in the "off" position. If the gap is greater, readjust brake as described under maintenance.

- b. Engine driven attachment rotates slower than normal, check for loose belts.
- Inspect engine driven attachment with clutch belt removed. Attachment should turn freely.
- Check clutch/brake pulley grooves for grease or oil.
- Check clutch/brake working surfaces for grease or oil.

**NOTE:**  
**REMOVE GREASE OR OIL FROM CLUTCH/BRAKE WORKING SURFACES AS OUTLINED UNDER MAINTENANCE.**

#### ELECTRIC P.T.O. CLUTCH SPECIFICATIONS

1666 0100101 to 0199999

Voltage 12 VDC  
Resistance 3.2 Ohms  
Current Draw 3.8 Amps

1666 & 1966 0200101 and later

Voltage 12 VDC  
Resistance 2.5 Ohms  
Current Draw 4.7 Amps

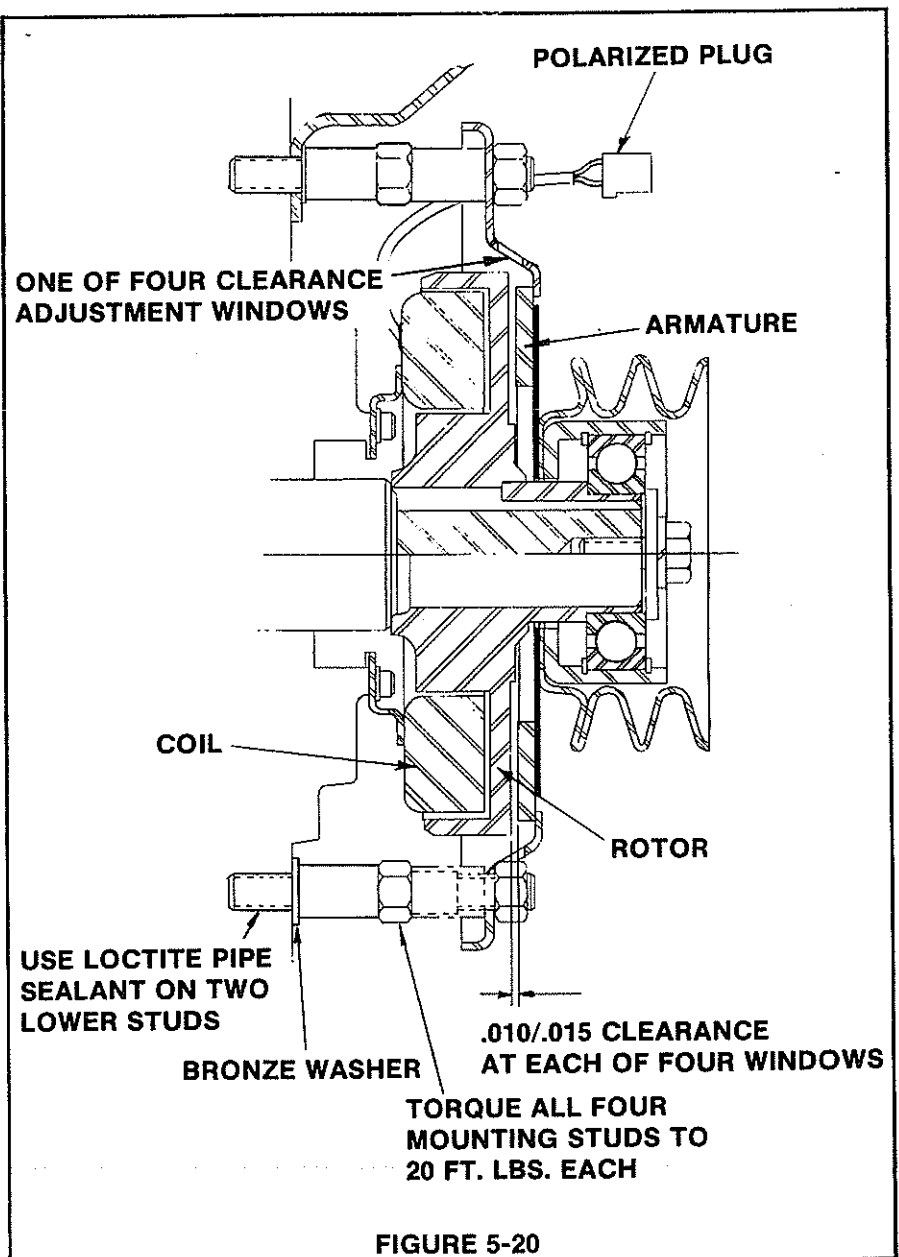


FIGURE 5-20

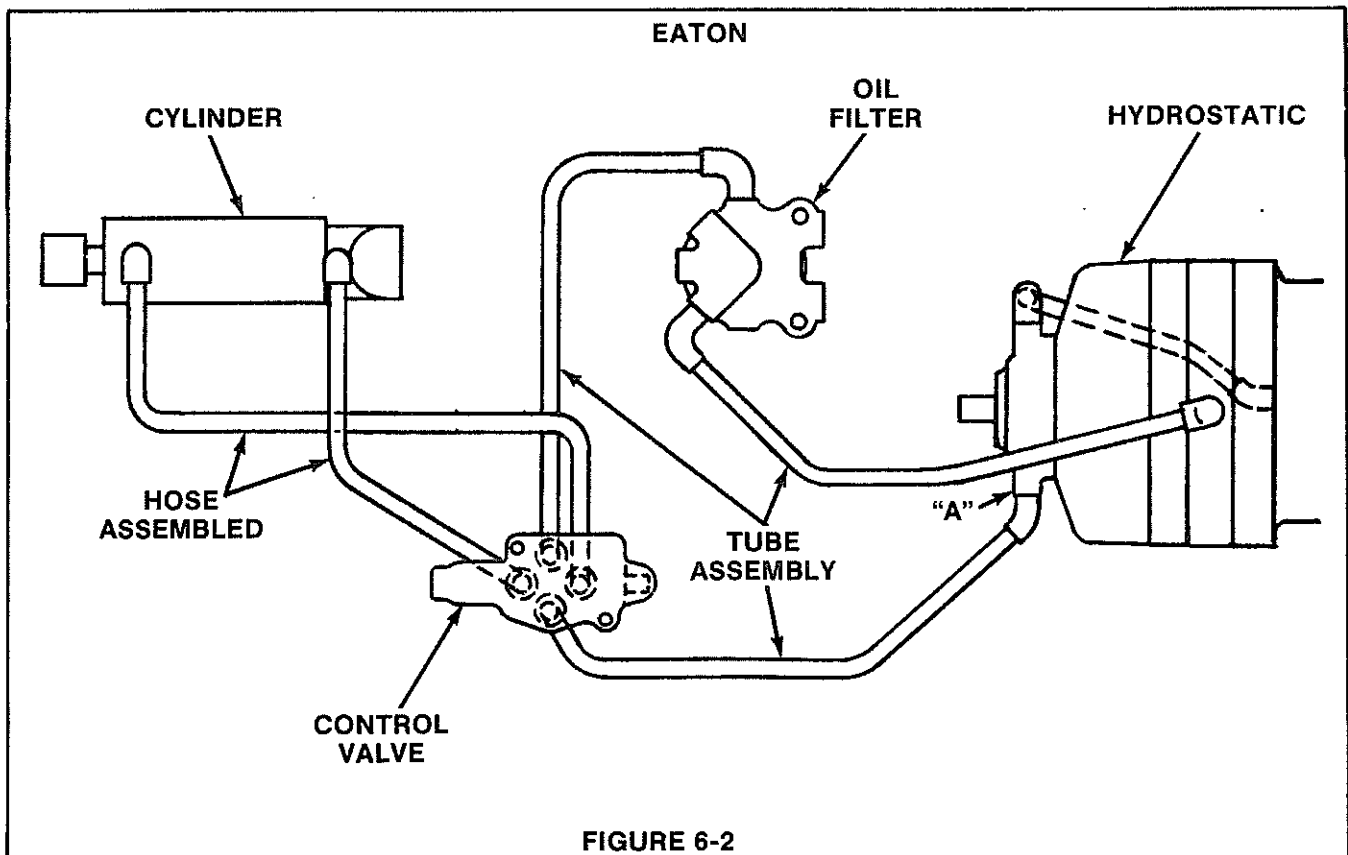
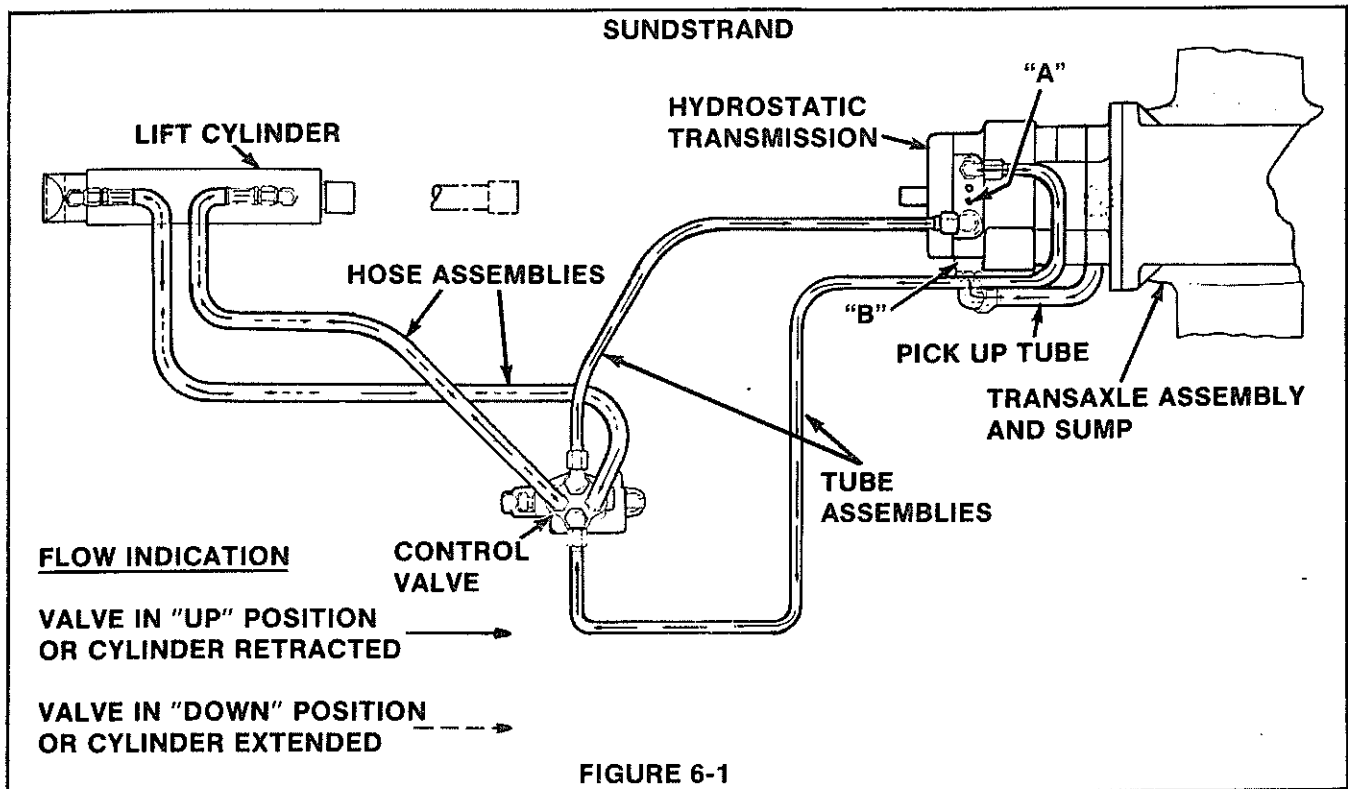
## GROUP VI. HYDRAULIC SYSTEM

QS, QT & 1900 SERIES  
Page 6-1 REV. 12/78

### TROUBLE SHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	REMEDY
Hydraulic lift inoperative	<ol style="list-style-type: none"><li>1. System low on oil</li><li>2. No charge pressure</li><li>3. Implement relief valve stuck open (Sundstrand)</li><li>4. Weak implement relief spring (Sundstrand)</li><li>5. Oil line leaking</li><li>6. Malfunctioning lift valve</li><li>7. Malfunctioning lift cylinder</li></ol>	<ol style="list-style-type: none"><li>1. Install gage and check pressure</li><li>2. Check level and refill</li><li>3. Check valve, clean or replace if necessary</li><li>4. Replace spring</li><li>5. Replace line</li><li>6. Repair or replace valve</li><li>7. Repair or replace cylinder</li></ol>
Load drops when control valve is in neutral position	<ol style="list-style-type: none"><li>1. Leaking hose from valve to cylinder</li><li>2. Oil leaking past lift cylinder "O" rings</li><li>3. Lift valve "O" rings leaking</li></ol>	<ol style="list-style-type: none"><li>1. Replace hose</li><li>2. Repair lift cylinder</li><li>3. Repair lift valve</li></ol>
Lift valve or lift cylinder leaking	<ol style="list-style-type: none"><li>1. Leaking "O" rings</li></ol>	<ol style="list-style-type: none"><li>1. Replace "O" rings</li></ol>

# HYDRAULIC SYSTEM (Continued)



## TESTING HYDRAULIC SYSTEM

### EATON MODELS

The hydrostatic and lift pressure can be checked using a pressure gauge which reads at least 1000 P.S.I. (6890 kPa).

To check the hydrostatic pressure install a tee hydraulic fitting between hydrostatic port (A) Figure 6-2 and existing hydraulic tube. Connect pressure gauge to hydraulic tee. Start engine and run for 5-10 minutes. At full RPM the pressure reading should be 140 P.S.I.  $\pm$  50 (964 kPa).

To check the lift pressure, move the hydraulic control valve lever to the lift position until the hydraulic

cylinder reaches the end of its travel. The pressure reading should be no less than 450 P.S.I. (3100 kPa).

If the pressure reading is 450 to 550 P.S.I. (3100 - 3790 kPa) and the hydraulic cylinder does not operate properly, check the following:

1. Load too heavy.

2. Restriction in line from hydro to hydraulic cylinder.
3. Malfunctioning cylinder or valve.

If the pressure reading is below 450 to 500 P.S.I. (3100 - 3790 kPa) and the hydraulic cylinder does not operate, check the following:

1. System low on oil.
2. Plugged oil filter or pickup tube line.
3. Hydraulic oil line leaking.
4. Hydraulic valve or cylinder leaking.

## TESTING HYDRAULIC SYSTEM

### SUNDSTRAND MODELS

The implement pressure can be checked using a pressure gauge which reads at least 1000 P.S.I. To check the implement pressure install the gauge into the hydrostatic Figure 6-3. Start the engine and run at full R.P.M. Move the hydraulic control valve lever to the lift position until the hydraulic cylinder reaches the end of its travel. The pressure reading should be no less than 550 P.S.I.

If the pressure reading is below 550 to 800 P.S.I. and the hydraulic cylinder does not operate, check the following:

1. Load too heavy.
2. Restriction in line from hydro to hydraulic cylinder.
3. Malfunctioning cylinder or valve.

If the pressure reading is below 550 to 800 P.S.I. and the hydraulic cylinder does not operate, check the following:

1. System low on oil.
2. Plugged oil filter or pickup tube line.
3. Hydraulic oil line leaking.
4. Malfunctioning implement relief valve.
5. Hydraulic valve or cylinder leaking.

### CHECKING THE IMPLEMENT RELIEF VALVE

Remove the implement relief valve from the hydro Figure 6-4 and inspect for a damaged valve or distorted spring. The relief valve spring could be too weak or the valve not seating properly. If the valve or spring is pitted, wore uneven, or distorted, replace.

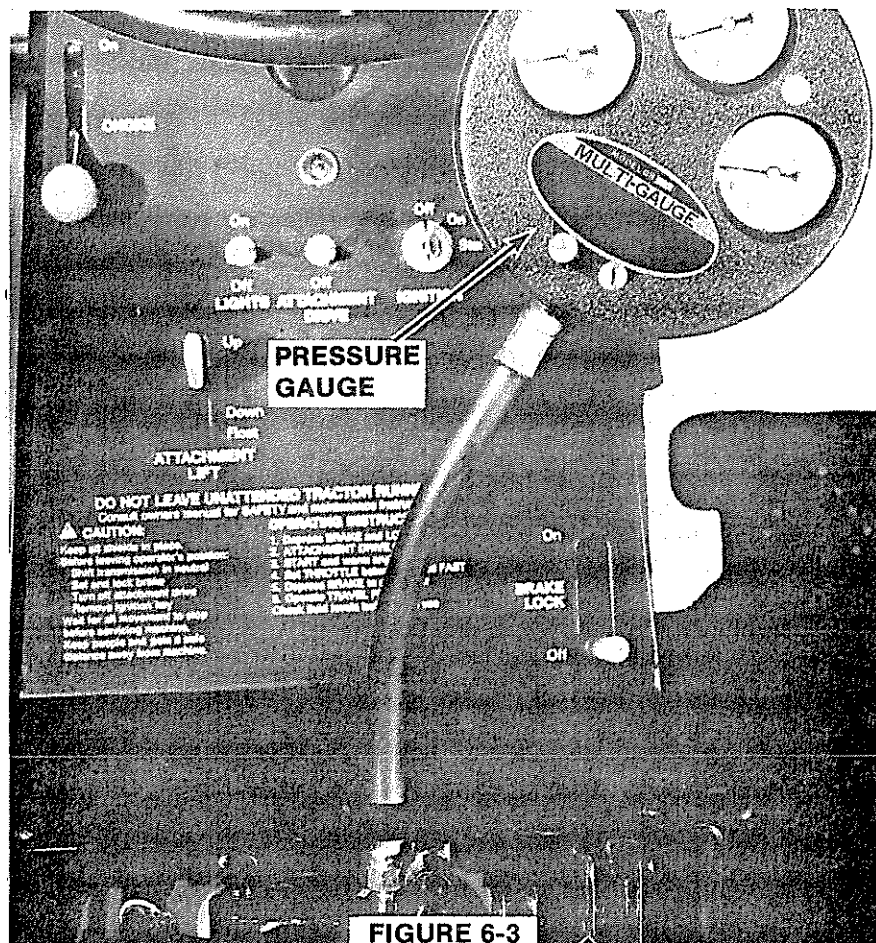


FIGURE 6-3

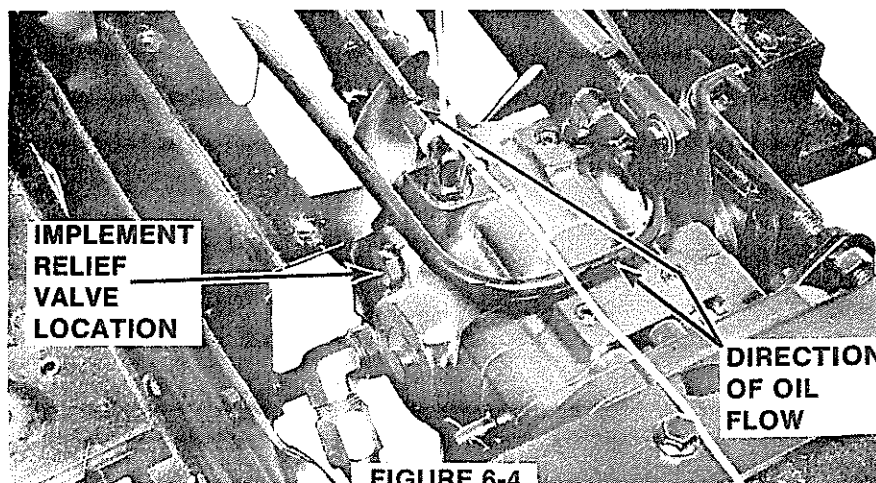


FIGURE 6-4

**NOTE:**  
**SHIMS ARE AVAILABLE TO INCREASE IMPLEMENT RELIEF VALVE PRESSURE. 1 SHIM .012" IN THICKNESS WILL INCREASE PRESSURE APPROXIMATELY 50 P.S.I.**

If no pressure reading is picked up on the gauge the charge pump relief valve could be stuck open or the charge pump inoperative. For further information on trouble shooting the hydrostatic, refer to the drive train, Group III.

## HYDRAULIC POWER LIFT

### ALL MODELS REPAIRING THE HYDRAULIC CYLINDER FIGURE 6-3

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 it is fully extended.
3. Pinch snap ring together and pull on piston rod until the assembly slides out of the cylinder housing.

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

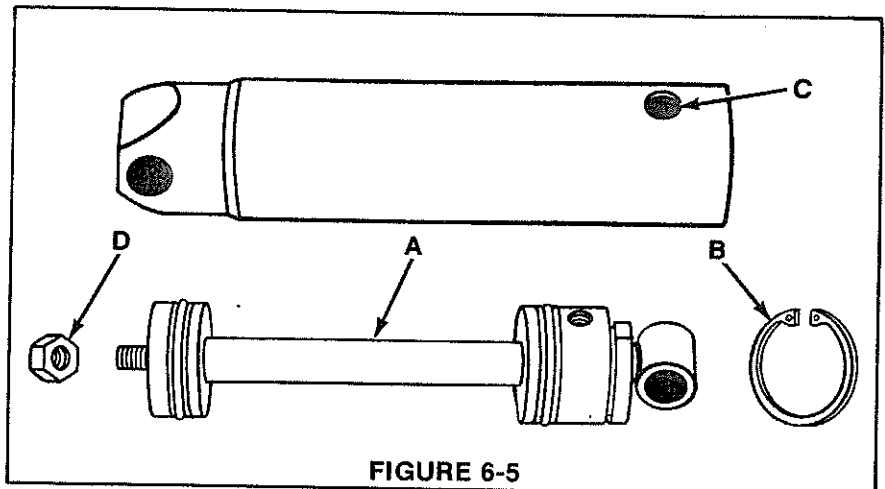


FIGURE 6-5

### HYDRAULIC CYLINDER LEGEND

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. "O" Ring
14. Hex Nut
15. Cylinder Tube

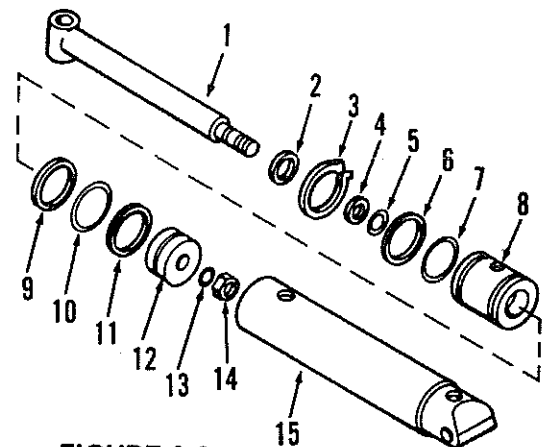
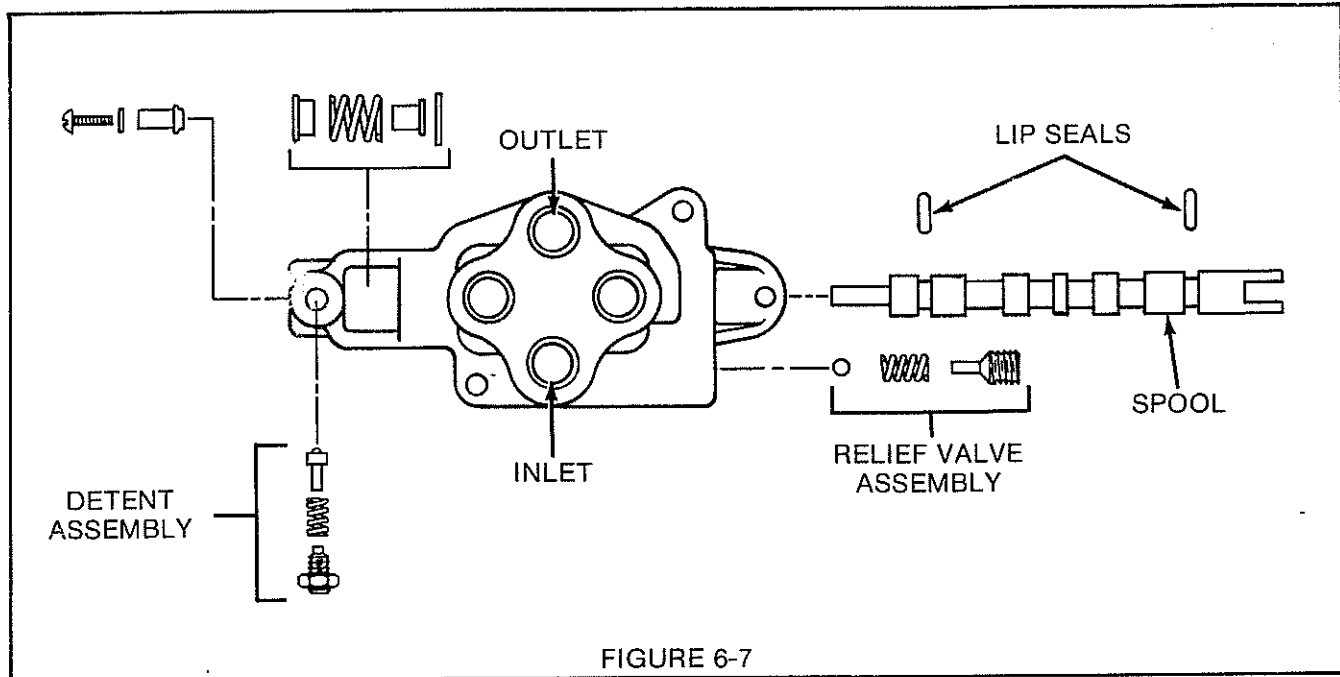


FIGURE 6-6

## HYDRAULIC SYSTEM (Continued)

### HYDRAULIC POWER LIFT



#### REPAIRING THE HYDRAULIC CONTROL VALVE

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.

Repair lip seals are available for the control valve.

#### 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, the detent ramp, spring, flat washer and spring guides. Remove the spool by pushing it out the lever end of the valve body. Be careful not to lose the spring loaded detent plug.

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 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. Install flat washer, spring, guide sleeve, spring guide and detent ramp onto end of spool. Secure to spool with capscrew and lockwasher.
4. Install detent, spring, adjusting screw and jam nut into detent housing of valve body.



## GROUP VII. ENGINE

QS, QT & 1900 SERIES  
Page 7-1 REV. 12/78

### TROUBLE SHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	REMEDY
Hard starting or loss of power	<ol style="list-style-type: none"><li>1. Engine overchoked</li><li>2. Carburetor dirty or improperly adjusted</li><li>3. Faulty spark plug or improper gap</li><li>4. Clogged fuel line or filter</li><li>5. Loose or grounded high tension wire</li><li>6. Worn or burnt breaker points</li><li>7. Faulty condenser</li><li>8. Faulty fuel pump</li><li>9. Loose or grounded break point wire leads</li></ol>	<ol style="list-style-type: none"><li>1. Close fuel petcock and engage starter until engine fires. Reopen fuel petcock</li><li>2. Readjust or clean carburetor</li><li>3. Adjust gap or replace plug</li><li>4. Check fuel line or filter</li><li>5. Check and repair wire lead</li><li>6. Replace breaker points</li><li>7. Replace condenser</li><li>8. Replace pump</li><li>9. Check and replace</li></ol>
Overheating	<ol style="list-style-type: none"><li>1. Insufficient available cool air</li><li>2. Dirty air intake screen, shroud or cooling fins</li><li>3. Improper fuel</li><li>4. Fuel mixture too lean</li><li>5. Improper ignition timing</li><li>6. Engine overloaded</li><li>7. Tight tappet clearance</li></ol>	<ol style="list-style-type: none"><li>1. Make sure area in front of flywheel is open</li><li>2. Clean intake screen, shroud and cooling fins</li><li>3. Clean and refill tank with proper fuel</li><li>4. Adjust carburetor</li><li>5. Reset timing</li><li>6. Lessen work load</li><li>7. Adjust tappets</li></ol>
Backfiring	<ol style="list-style-type: none"><li>1. Fuel mixture too lean</li><li>2. Improper timing</li><li>3. Valve "sticking"</li></ol>	<ol style="list-style-type: none"><li>1. Adjust carburetor</li><li>2. Reset timing</li><li>3. Free up valve</li></ol>

7

## ENGINE (Continued)

### TROUBLE SHOOTING GUIDE (Continued)

PROBLEM	PROBABLE CAUSE	REMEDY
Skip at high speed	<ol style="list-style-type: none"><li>1. Spark plug gap too wide</li><li>2. Improper carburetor setting or lack of fuel</li><li>3. Wrong type spark plug. Use recommended spark plug</li><li>4. Improper timing</li></ol>	<ol style="list-style-type: none"><li>1. Adjust spark plug gap</li><li>2. Refill tank and adjust carburetor</li><li>3. Install correct spark plug</li><li>4. Reset timing</li></ol>
Operating erratically	<ol style="list-style-type: none"><li>1. Clogged fuel line</li><li>2. Water in fuel</li><li>3. Faulty choke control</li><li>4. Improper fuel mixture</li><li>5. Loose ignition connections</li><li>6. Air leaks in manifold or carburetor connections</li><li>7. Vent in gas cap plugged</li><li>8. Fuel pump faulty</li></ol>	<ol style="list-style-type: none"><li>1. Clean fuel line</li><li>2. Clean fuel system</li><li>3. Replace choke control</li><li>4. Adjust carburetor</li><li>5. Clean and tighten ignition connections</li><li>6. Tighten manifold and carburetor</li><li>7. Clean gas cap vent</li><li>8. Replace fuel pump</li></ol>
Engine will not idle	<ol style="list-style-type: none"><li>1. Improper carburetor idling adjustment</li><li>2. Carburetor clogged</li><li>3. Spark plug gap set too close</li><li>4. Leaking carburetor or manifold gaskets</li></ol>	<ol style="list-style-type: none"><li>1. Adjust idle speed</li><li>2. Clean carburetor</li><li>3. Adjust spark plug gap</li><li>4. Replace gaskets</li></ol>

## ENGINE REMOVAL

### QT-16 ONAN ENGINE REMOVAL AND REINSTALLATION

1. Remove hood and side panels.
2. Disconnect NEGATIVE battery cable.
3. Disconnect electric clutch, coil, alternator and starter cable.
4. Close fuel tank petcock and disconnect fuel line at fuel pump. Unhook gas line at bottom blower housing clip.
5. Unhook PTO idler spring and remove PTO belts.
6. Remove air cleaner assembly, choke and throttle cables.
7. Remove the 4 rubber mount bolts and driveline staybolt. Remove drive shaft.
8. Remove the top screws and loosen bottom screws from the top panel Right and Left support brackets. Pivot brackets forward and down.
9. Raise engine and cradle assembly up and out of tractor frame.

#### NOTE:

- A. BEFORE REINSTALLING ENGINE, CHECK RUBBER MOUNTS FOR DAMAGE OR FATIGUE CRACKS.
- B. INSPECT HYDRO INPUT SHAFT AND KEY.
- C. INSPECT ENGINE SHAFT AND KEY. COAT BOTH WITH NEVER-SEEZ BEFORE REINSTALLING.

#### NOTE:

IF THE RUBBER ENGINE MOUNTS HAVE BEEN REMOVED FOR ANY REASON, THE MORE RIGID MOUNT WITH THE

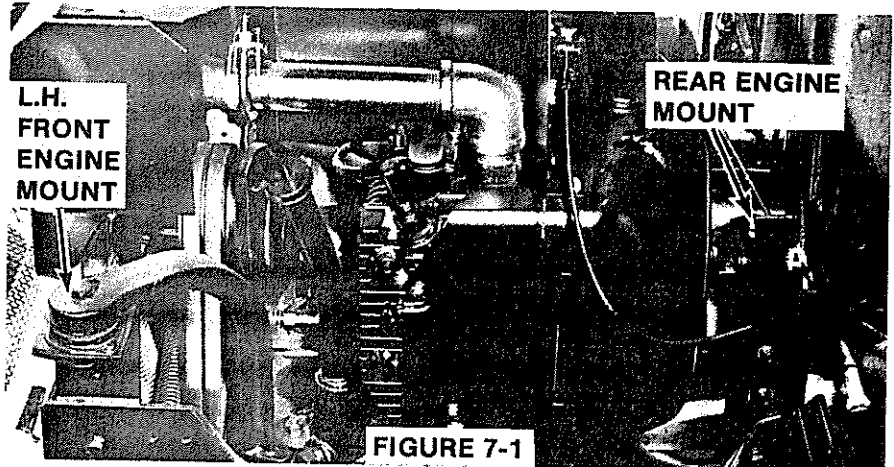


FIGURE 7-1

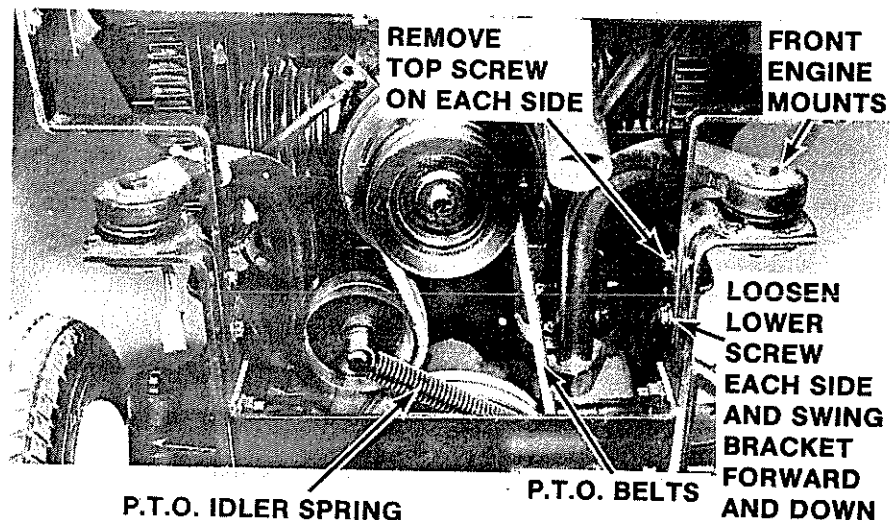


FIGURE 7-2

LOWER CENTER IS THE "FRONT" MOUNT AND THE MORE FLEXIBLE MOUNT WITH THE HIGHER CENTER IS THE "REAR" MOUNT.

10. Set engine and cradle assembly into frame on the 4 mounting brackets and insert bolts loosely.

**CAUTION:** Recheck routing of alternator leads to prevent abrasion.

11. Reinstall driveline and insert staybolt into engine shaft.
12. Tighten four engine mounting bolts securely.

13. Install PTO belts and position spring.

14. Run engine before reinstalling side panels and hood.

#### NOTE:

BOTH IN AND OUT OF WARRANTY REPAIR OF THE ONAN BF ENGINE AS USED IN THE QT16 TRACTOR CAN BE PERFORMED BY AUTHORIZED BOLENS DEALERS. A SEPARATE MANUAL COVERING ENGINE REPAIR IS AVAILABLE. ORDER FORM NO. B965-250 FROM YOUR NORMAL PARTS SOURCE.

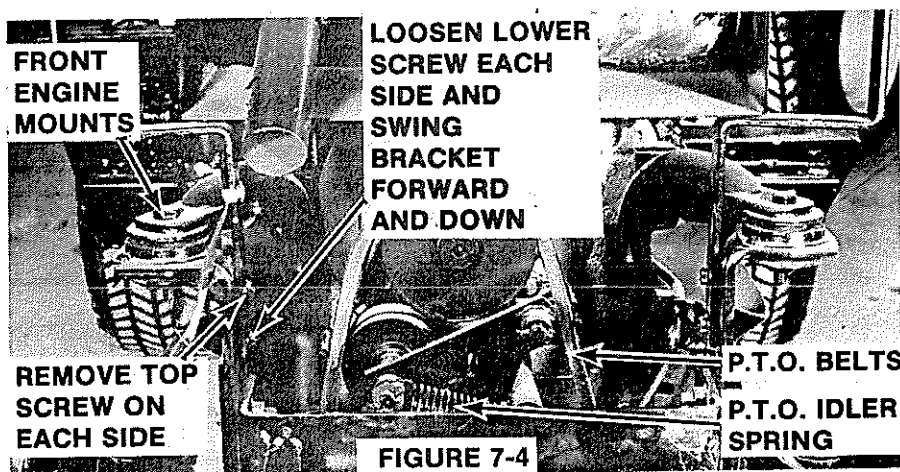
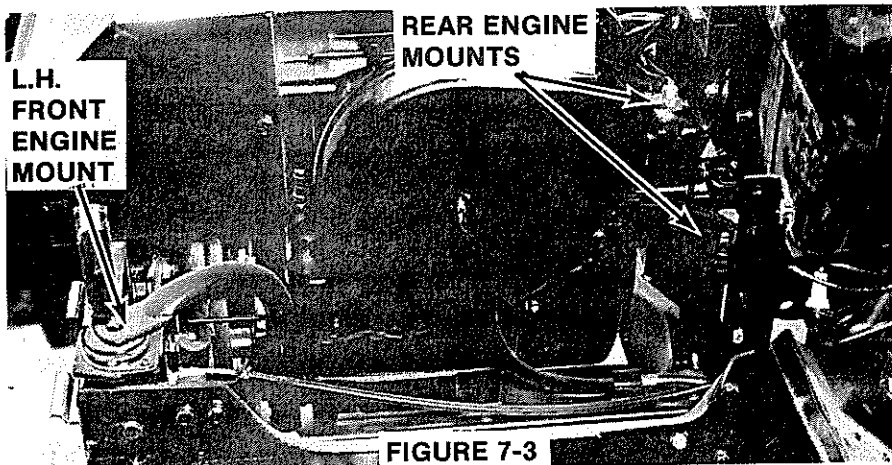
## ENGINE REMOVAL

### QS-16 KOHLER ENGINE REMOVAL AND REINSTALLATION

1. Remove hood and side panels.
2. Disconnect NEGATIVE battery cable.
3. Disconnect headlight, alternator-ignition connectors and starter cable.
4. Disconnect choke and throttle cables.
5. Close fuel valve and unhook fuel tank holddown spring.
6. Disconnect fuel line at fuel pump inlet. Remove fuel tank, fuel filter and complete fuel line from tractor.
7. Disconnect PTO clutch return spring. With clutch lever in "ON" position, remove cotter pin and washer at lower Right Hand brake anchor stud and remove brake band from stud.
8. With clutch lever in "OFF" position, remove belts from pulleys.
9. Remove belt idler pivot bolt from axle bolster and remove complete idler arm assembly.
10. Remove the 4 rubber mount bolts and driveshaft staybolt. Hold driveshaft at hydro to prevent damage to fan as rear joint clears hydro input shaft. Slide driveline forward on engine shaft. Remove driveshaft.
11. Raise engine and cradle assembly up and out of tractor frame.

#### NOTE:

##### A. BEFORE REINSTALLING



- ENGINE, CHECK RUBBER MOUNTS FOR DAMAGE OR FATIGUE CRACKS.**
- B. INSPECT HYDRO INPUT SHAFT AND KEY.**
- C. INSPECT ENGINE SHAFT AND KEY. COAT BOTH WITH NEVER-SEEZ BEFORE REINSTALLING.**
- NOTE:**  
**IF THE RUBBER ENGINE MOUNTS HAVE BEEN REMOVED FOR ANY REASON, THE MORE RIGID MOUNT WITH THE LOWER CENTER IS THE "FRONT" MOUNT AND THE MORE FLEXIBLE MOUNT WITH THE HIGHER CENTER IS THE "REAR" MOUNT.**

12. Set engine and cradle assembly into frame on the 4 mounting brackets and insert bolts loosely.

13. Reinstall drive line and insert stay-bolt into engine shaft.
14. Tighten four engine mounting bolts securely. Right rear carries extra halfnut to attach electrical ground.
15. Reinstall PTO belts, brake band and linkages.
16. Run engine and observe belt guide behavior before reinstalling side panels and hood.

#### NOTE:

**IN WARRANTY REPAIR OF THE KOHLER K341 AQS ENGINE MUST BE PERFORMED BY AN AUTHORIZED KOHLER DEALER.**

## ENGINE REMOVAL

### KT17 AND KT19 KOHLER ENGINE REMOVAL AND REIN- STALLATION (FIGURE 7-5)

1. Disconnect light harness (A).
2. Remove hood and side panels (if equipped).
3. Disconnect electric clutch (B), alternator-ignition connectors and starter cable (C). Pull through engine heat shield.
4. Disconnect battery cables and remove battery.
5. Remove air cleaner from engine.
6. Disconnect choke and throttle cables. Pull through heat shield.
7. Close fuel valve and disconnect fuel line from filter at engine side (D). Pull through shield.
8. Remove fuel tank.
9. Loosen side panel supports (E) and pivot away from engine (if equipped).
10. Disconnect PTO clutch idler spring and remove PTO belts.
11. Disconnect right rear engine support (F). Take note the position of the ground wires.
12. Remove the three remaining engine support bolts (G).
13. Remove drive shaft bolt. Slide drive shaft off of engine stub shaft.
14. Raise engine and support assembly up and out of tractor frame.

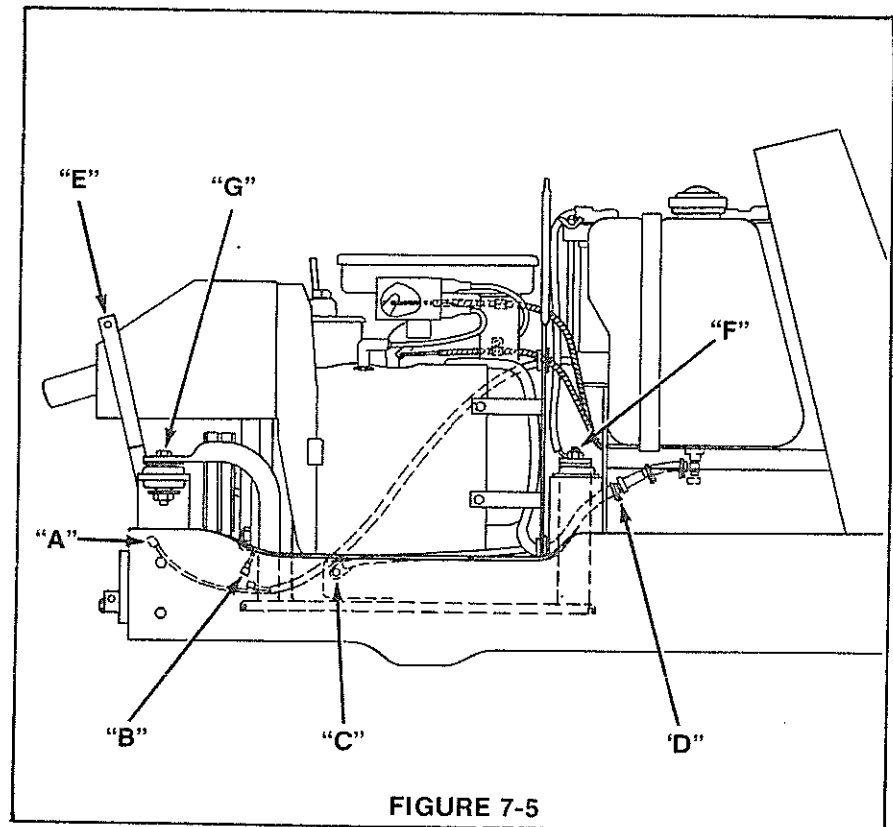


FIGURE 7-5

#### NOTE:

A. BEFORE REINSTALLING ENGINE, CHECK RUBBER MOUNTS FOR DAMAGE OR FATIGUE CRACKS.

B. INSPECT ENGINE SHAFT AND KEY. COAT BOTH WITH NEVER-SEEZ BEFORE INSTALLING.

#### NOTE:

IF THE RUBBER ENGINE MOUNTS HAVE BEEN REMOVED FOR ANY REASON, THE MORE RIGID MOUNT WITH THE LOWER CENTER IS THE "FRONT" MOUNT AND THE MORE FLEXIBLE MOUNT WITH THE HIGHER CENTER IS THE "REAR" MOUNT.

15. Reverse the above procedure when reinstalling engine.

16. Torque engine drive shaft bolt to 49 in. lbs. (5.5 N.m).

17. Torque four engine support bolts to 23 ft. lbs. (31 N.m).

#### NOTE:

WARRANTY REPAIR OF THE KOHLER K.T. 17 & K.T. 19 ENGINE MUST BE PERFORMED BY AN AUTHORIZED KOHLER DEALER.

## MOWER DECKS

### MOWER LEVELING

1. Place the tractor on a level surface. Check tires for proper pressure.  
Front — 12 PSI (88 kPa)  
Rear — 8 PSI (55 kPa)
2. Lower mower to the ground.
3. Set gauge wheels to the 3 inch cutting height. Place a two foot level across the mower deck, to check for front to rear leveling.

### NOTE

IF A TWO FOOT LEVEL IS NOT AVAILABLE USE A SMALLER LEVEL AND A METAL STRAIGHT EDGE SUCH AS A CARPENTER'S SQUARE.

Loosen capscrews (A) Figure 8-1.

Turn adjusting screw (B) or nut (C) Figure 8-1, clockwise to raise the front of mower and counterclockwise to lower.

### NOTE

TURN BOTH ADJUSTING SCREWS THE SAME NUMBER OF TURNS TO MAINTAIN THE SIDE TO SIDE LEVEL.

After mower is adjusted, securely retighten capscrews (A).

### GEAR CASE REMOVAL AND DIS-ASSEMBLY (Models 19209, 19210 & 19211)

1. Remove universal joint.
2. Remove the mower R.H. cover and 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.
5. Remove output shaft (A), Figure 8-2, as follows:
  - a. Remove drive sheave (B) and wood-ruff key. Remove any burrs on end of shaft.

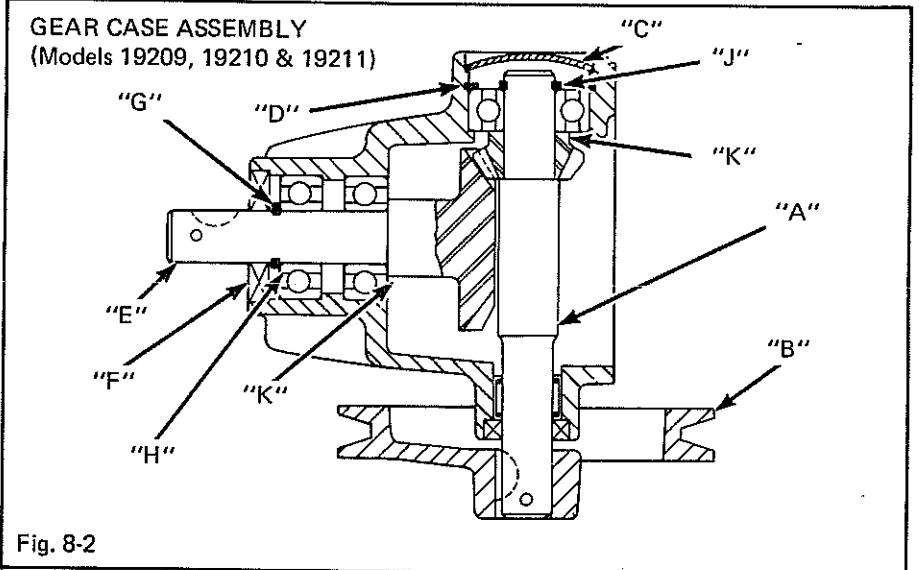
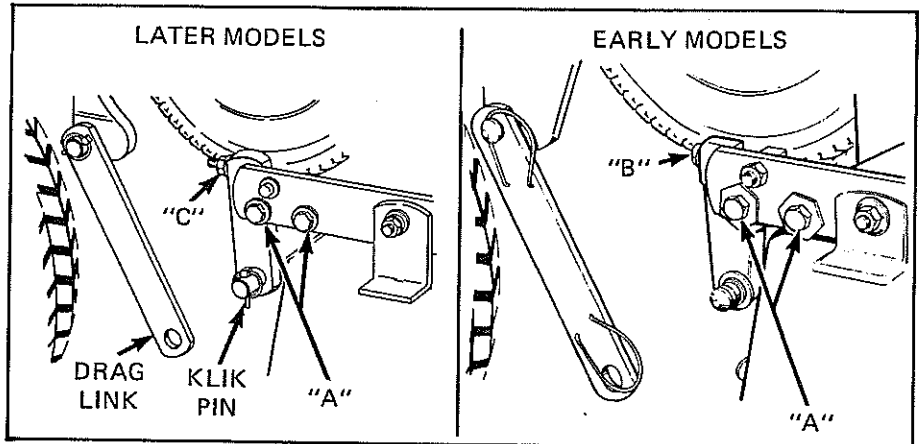


Fig. 8-2

- 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). Pull shaft out.

### 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" (0.12 mm) end play. To achieve

correct end play, shim at point (H). See parts list for shim numbers.

4. Insert output shaft (A) with 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. If gears are loose shim as required at points (H), (J) or (K) to remove gap. See parts list for shim numbers.

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

7. Install drive pulley to output shaft.

## MOWER DECKS

8. Remount gear case assembly with gasket to mower base. Apply sealant to both side of gasket before assembly. Fill gear case with 11 oz. (0.32 liter) of EP90 gear lube.

9. Install belt and belt cover to mower.

### GEAR CASE DISASSEMBLY (Model 19212)

1. Remove the universal joint, R.H. belt cover and remove belt from the gear case.

2. Disassemble the gear box from the mower support.

3. Remove the rear plug and drain the oil.

4. Remove drive pulley and woodruff key from output shaft (A). Remove any burrs on end of shaft.

5. Remove cover (B) and roller bearing (C).

6. Slide output shaft assembly out of case.

7. Remove cover (D).

8. Through gear case opening, remove cotter pin and nut (E).

9. Slide gear (F) off of input shaft and remove woodruff key (G) and shims (H).

10. Remove oil seal (I) and slide input shaft (J) out.

11. Replace all worn parts.

### GEAR CASE ASSEMBLY

1. If required, remove and replace any bearings and oil seals.

2. Insert input shaft (J) through bearings.

3. Slide shims (H) on shaft and install woodruff key (G).

4. Install gear (F) and secure using nut (E) and cotter pin.

### GEAR CASE BREAKDOWN (Models 19209, 19210 and 19211)

- 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

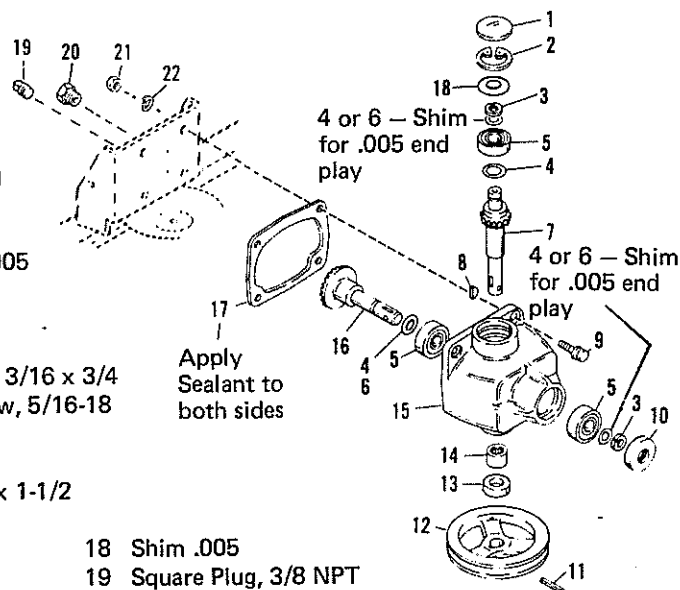


Fig. 8-3

### GEAR CASE ASSEMBLY (Model 19212)

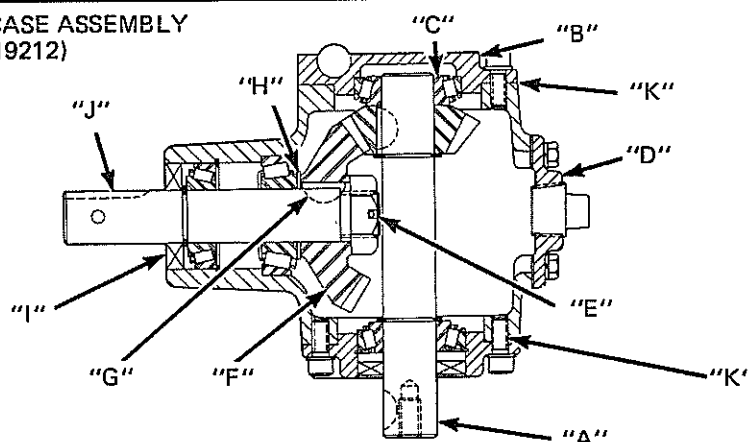


Fig. 8-4

5. Install output shaft (A) assembly and bearing into case.

6. Install cover (B).

7. Check backlash between gears. Shim, if required, to achieve a maximum of .006" (0.15 mm) backlash. Check backlash by holding shaft (A) and turning shaft (J). If gears move hard remove required shims (H). If loose shim at points (H) and (K). See parts list for shims.

8. Install oil seal (I).

9. Secure cover (D).

10. Fill gear case with 11 oz. (0.32 liter) of EP90 gear lube.

11. Install drive pulley to output shaft.

12. Reinstall gear case to mower.

13. Install belt and belt cover.

## MOWER DECKS

### GEAR CASE BREAKDOWN (Model 19212)

- 1 Capscrew, 5/16-18 x 3/4
- 2 Lockwasher, 5/16
- 3 Bearing Retainer
- 4 Gasket
- 5 Gasket
- 6 Bearing Cup
- 7 Bearing Cone
- 8 Retaining Ring
- 9 Gear Case
- 10 Breather
- 11 Retaining Ring
- 12 Oil Seal
- 13 Input Shaft
- 14 Woodruff Key, 1/4 x 7/8
- 15 Bevel Pinion, 18T
- 16 Shaft, Output
- 17 Bearing, Retainer
- 18 Shim, 1-1/2 x .003
- 19 Shim, .015
- 20 Slotted Nut, 7/8-14 UNF
- 21 Lockwasher, 1/4
- 22 Capscrew, 1/4-20 x UNC-3
- 23 Plug, 3/4-14 NPT
- 24 Cover
- 25 Gasket Cover
- 26 Cotter Pin, 1/8 x 1-1/2
- 27 Gear, 29T
- 28 Shim 1-1/2 x .005
- 29 Bearing Cone
- 30 Bearing Cup
- 31 Gasket, .030

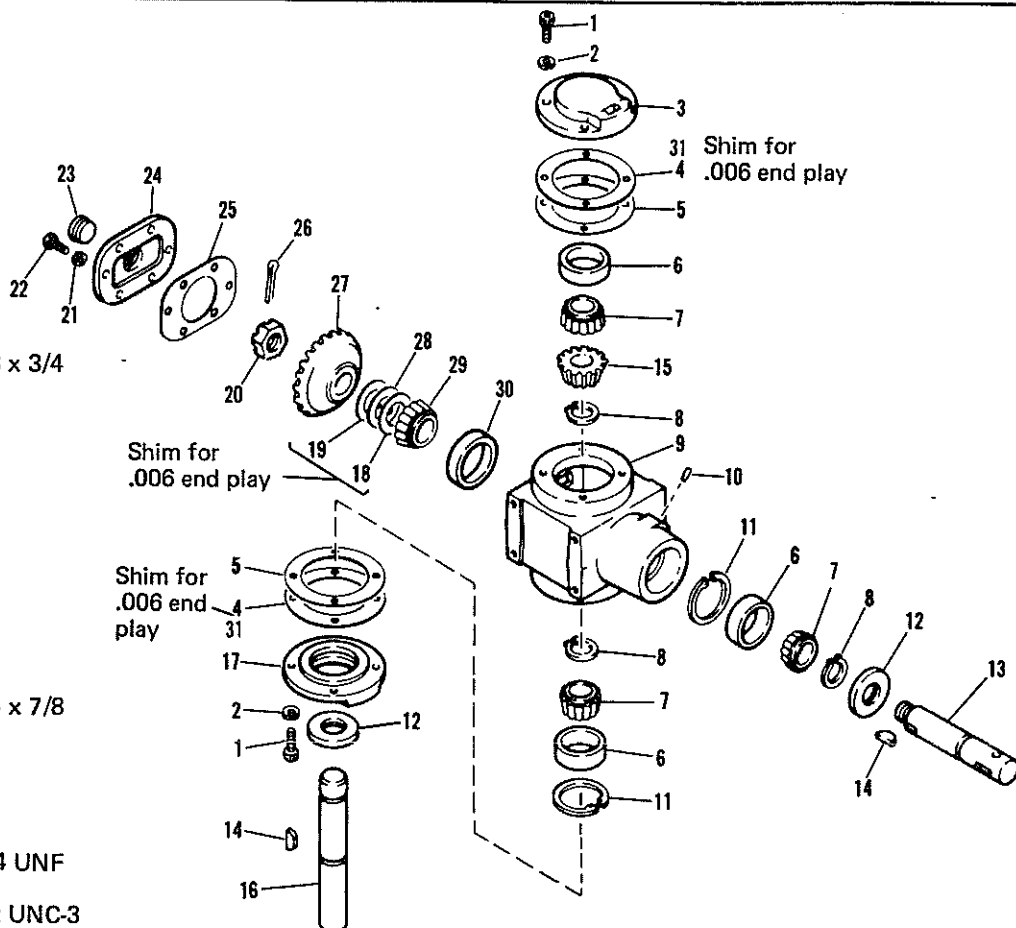


Fig. 8-5



## MOWER DECKS

### SPINDLE REMOVAL AND DISASSEMBLY (Figure 8-6)

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

### SPINDLE ASSEMBLY (Figure 8-6)

1. Place bearing (C) on shaft assembly.
2. Place spacer (D) on shaft assembly.
3. Place shaft assembly in spindle housing.
4. Place other bearing (E) on shaft assembly.
5. Place spindle housing assembly on mower deck and secure. Torque four (4) bolts (B) to 250 in. lbs. (28 Nm).
6. Assemble spindle sheave (A). Secure nut and torque to 90 ft. lbs. (122 Nm).
7. Assemble blade, spacer and bolts with lockwashers.
8. Torque bolts to 25 ft. lbs. (34 Nm).

### LUBRICATION

There are three grease fittings on the mower; one on top of each blade spindle. Lubricate these grease fittings after every 100 hours of operation with FMC Bolens multi-purpose grease and grease gun.

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

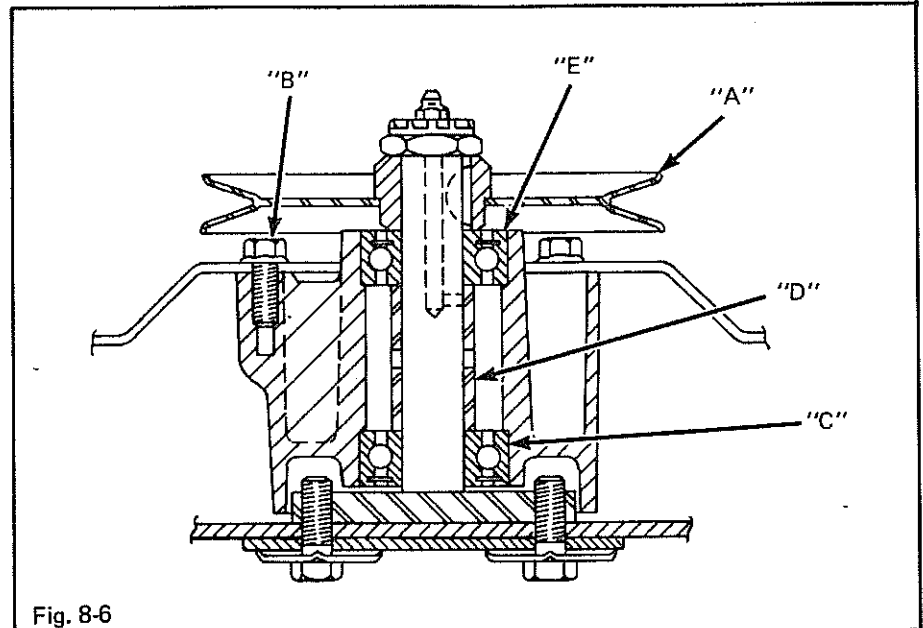


Fig. 8-6

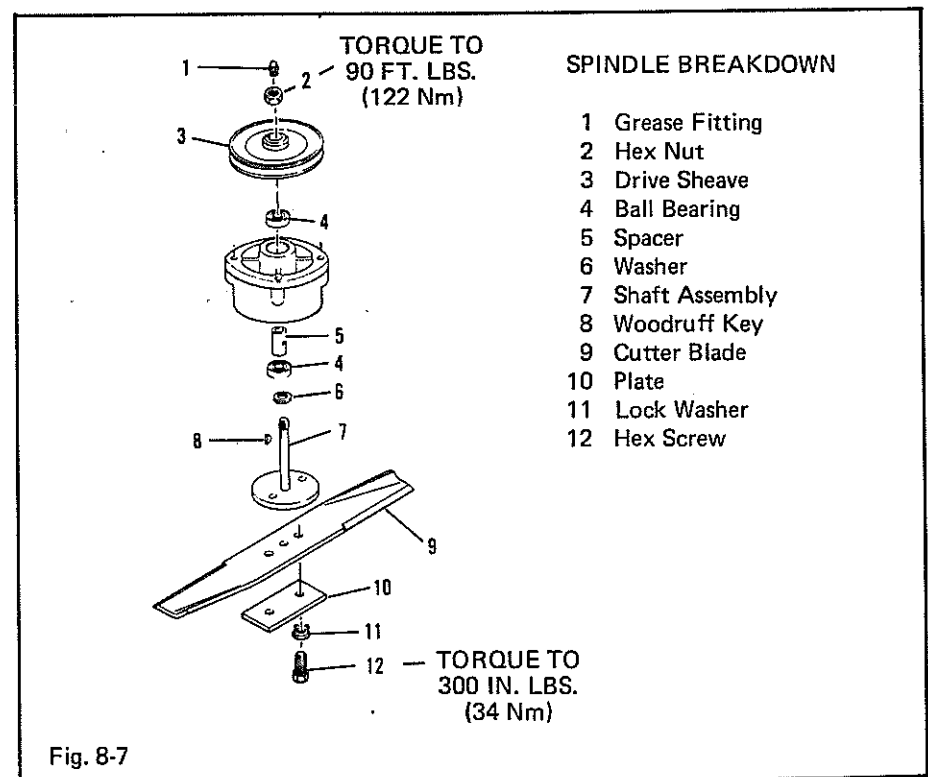


Fig. 8-7

## SNOW THROWER

### CHAIN REMOVAL

1. Remove four screws (A), from guard.
2. Loosen tension block (B) on chain.
3. Locate master link in chain and remove. Chain can now be slipped out.

### CHAIN INSTALLATION

The chain is properly adjusted when it has approximately 1/8" (3 mm) of slack. A chain too loose is inclined to jump and too tight a chain will cause excessive wear of chain and sprockets.

1. Place chain on sprockets.
2. Assemble master link to chain ends.
3. Remove slack of chain with tension block (B) and secure in place.
4. Reinstall guard.

### AUGER REMOVAL

1. Remove chain.
2. Remove the (6) 3/8 x 1/2" screws and lock washers (C) securing the bearings to the housing.
3. Auger should freely slide out.
4. If auger is to be replaced, remove the (2) end bearings. Bearings can be removed with a wheel puller or by heating them.

### AUGER REINSTALLATION

1. Coat both ends of auger shaft with loctite Grade D.
2. Place new or old bearings over loctite ends of auger shaft.
3. Place auger in the housing and re-secure guard bearing (D) using existing hardware.
4. Install chain.

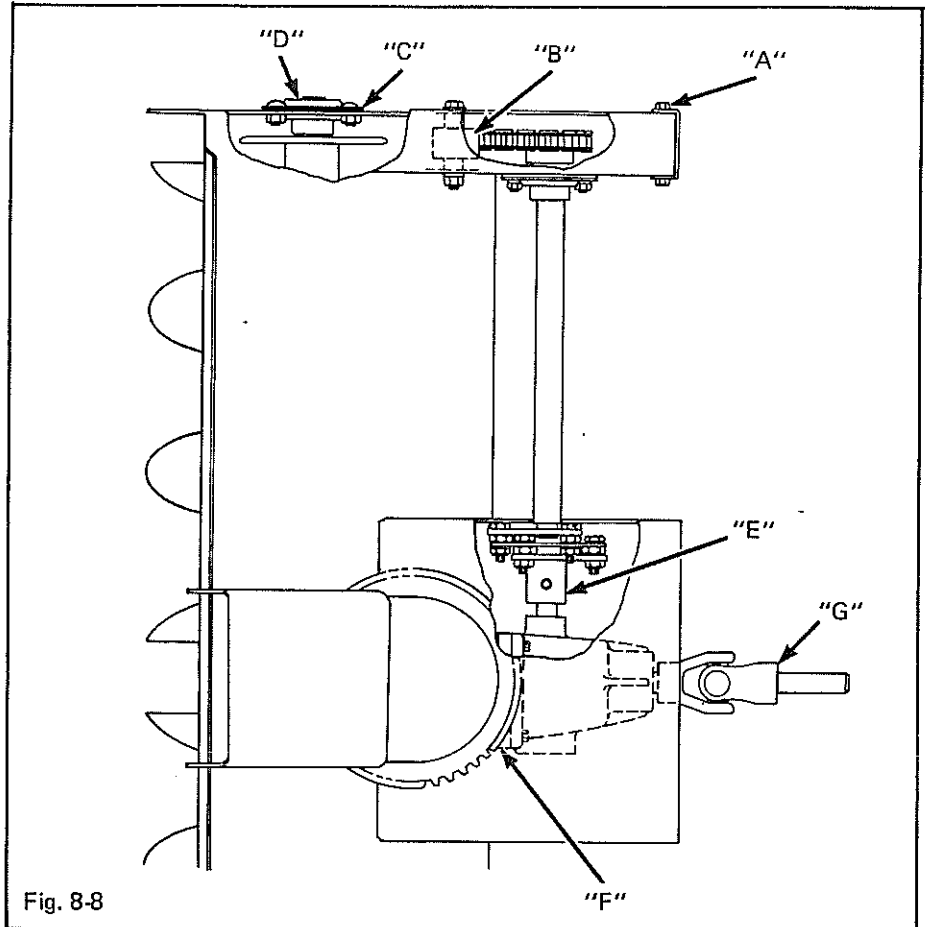


Fig. 8-8

### GEAR CASE REMOVAL

1. Loosen set screws in hub (E) to free shaft of gear box.
2. Remove universal joint (G).
3. Place oil pan under gear case.
4. Remove (4) 5/16-18 screws securing gear box.
5. Remove gear box and gasket. Drain oil.

### GEAR CASE INSTALLATION

1. Apply sealant to gear case gasket.
2. Place gasket and gear case in place and secure using (4) 5/16-18 x 3/4 screws.

3. Secure hub (E) in place with set screws.

4. Reinstall universal joint.

5. Fill gear case through oil plug (F) on L.H. side of housing casting with SAE 90 gear lube. Fill to plug level.

# SNOW THROWER

## GEAR CASE DISASSEMBLY

1. Remove plug (A).
2. Remove snap ring (B).
3. Slide output shaft (C) down until shaft clears gear (D). Remove gears and any shims.
4. Remove outer snap ring (E) and bearing (F).
5. Slide output shaft out.
6. Remove input shaft by removing oil seal (G) and snap ring (H). Slide shaft out.

## GEAR CASE ASSEMBLY

1. If necessary, remove and replace all oil seals and bearings.
2. Slide input shaft in place and lock with snap ring (H).
3. Slide out shaft through needle bearing (I).
4. Install bearing (F) and outer snap ring (E).
5. Place ear (D) and any previous shims in position and slide output shaft through.
6. Lock with snap ring (B).
7. Check end play of shafts. If gears are loose, shim at points (J).
8. Check shafts for correct gear mesh. Hold output shaft and turn input shaft. If gears turn hard, remove required shims at point K and add to point L. If gears are loose add shims at point K from point L. See parts list for shim numbers.
9. Install oil seal (G).

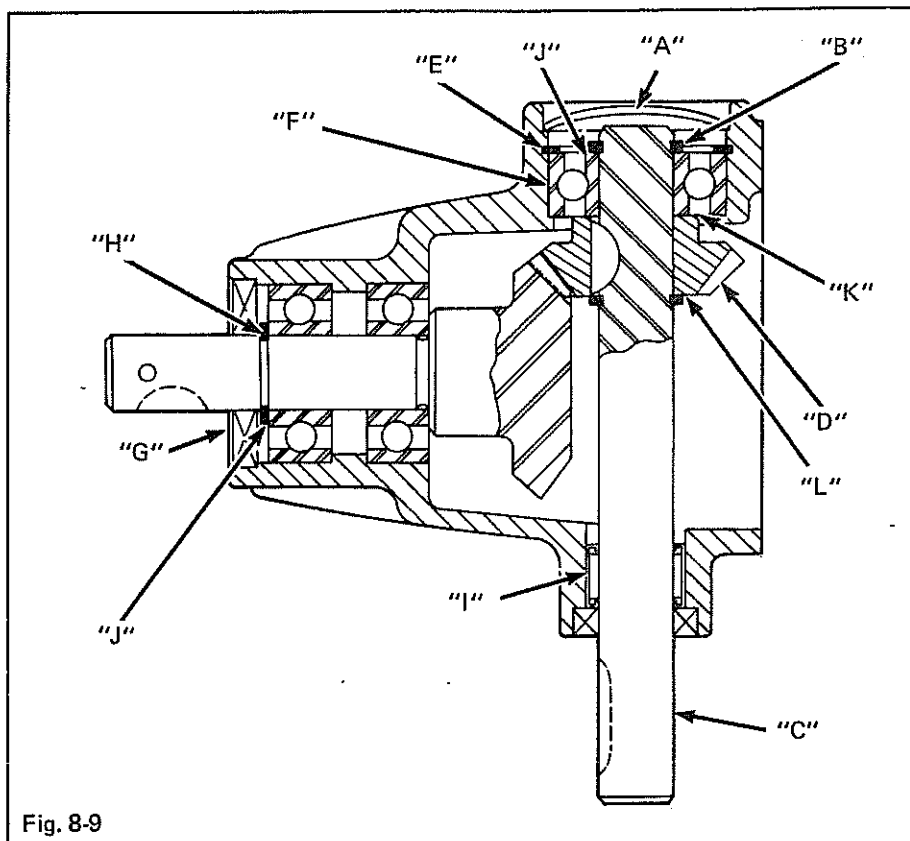


Fig. 8-9

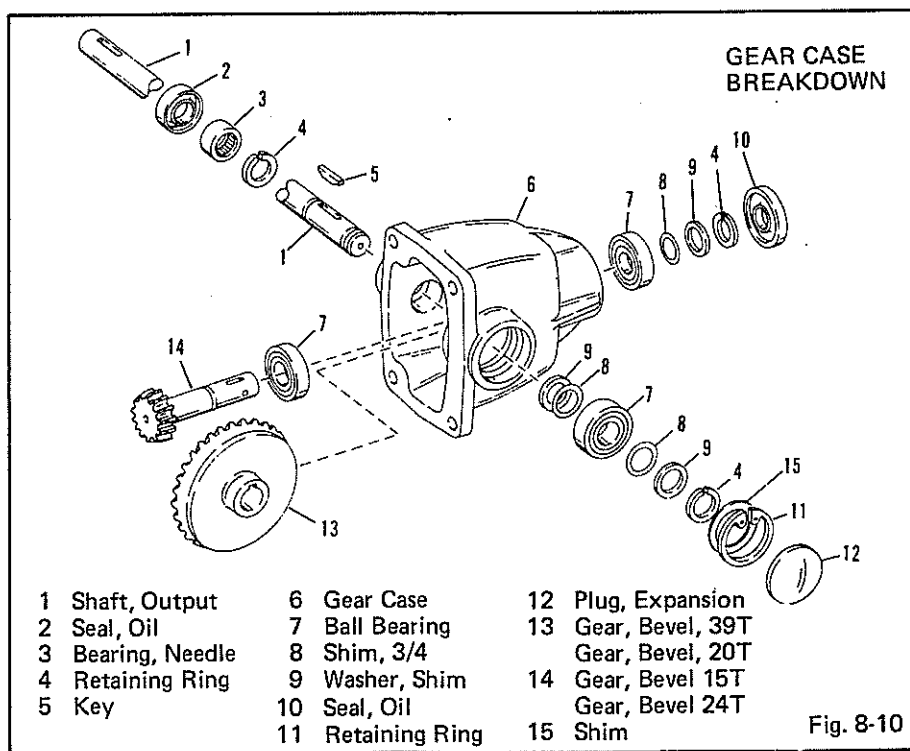


Fig. 8-10

### TILLERS

#### GEAR CASE REMOVAL

1. Remove tiller from tractor.
2. Remove hood.
3. Remove R.H. and L.H. supports (A).
4. Remove depth shoe (B).
5. Remove tiller tines from gear case shafts by either loosening nuts (C) through hole (D) or by removing tine hubs (E) to loosen nuts.

#### GEAR CASE REINSTALLATION

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

#### GEAR CASE DISASSEMBLY

1. Remove cover side woodruff key 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 Figure 8-12 and 8-13 for assembly.
2. Before assembling oil seal (B) check end play of input shaft (C) and gear (D). End play should not exceed .003" (0.07 mm). If required, shim at point (E).
3. Check backlash of gears. If gears move hard, remove required shims at point (F) and add shims at point (E).

If gears are loose remove shims at point (E) and add shims at point (F). See parts list for shim numbers.

4. Assemble oil seal (B).
5. When tine shaft (G) is reassembled, 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) to hole (L) level with EP90 gear lube.

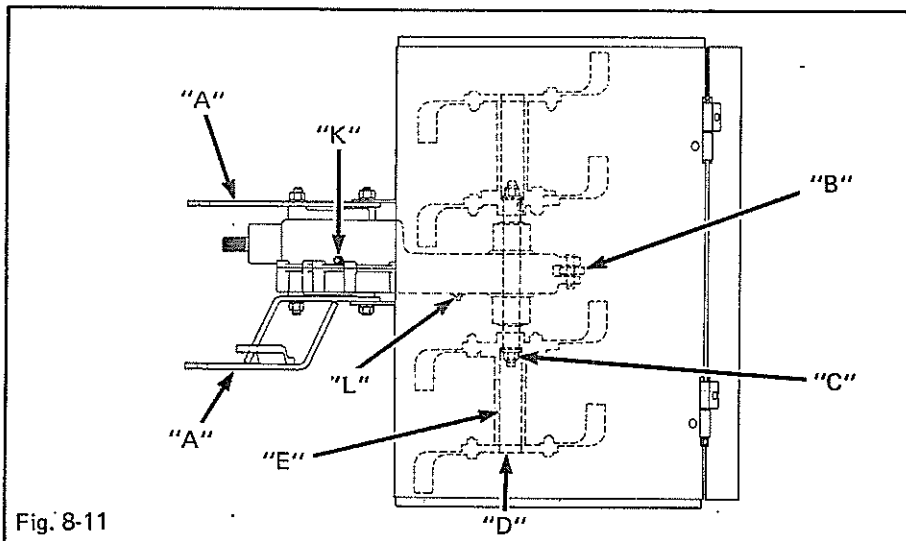


Fig. 8-11

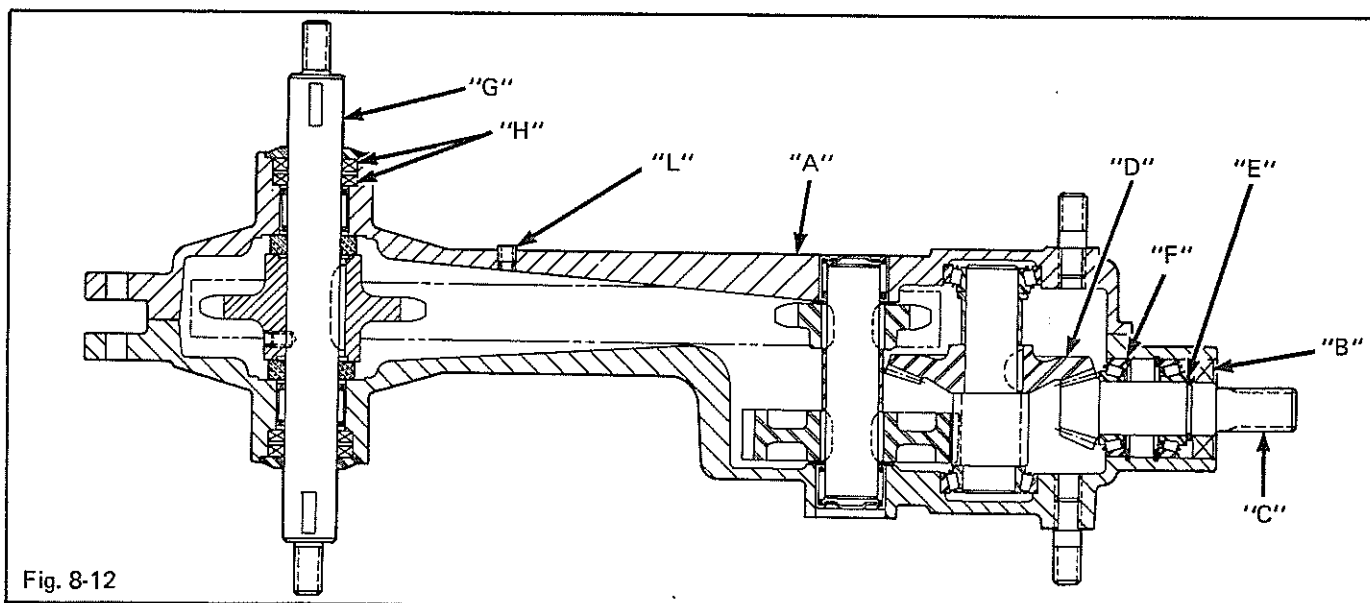
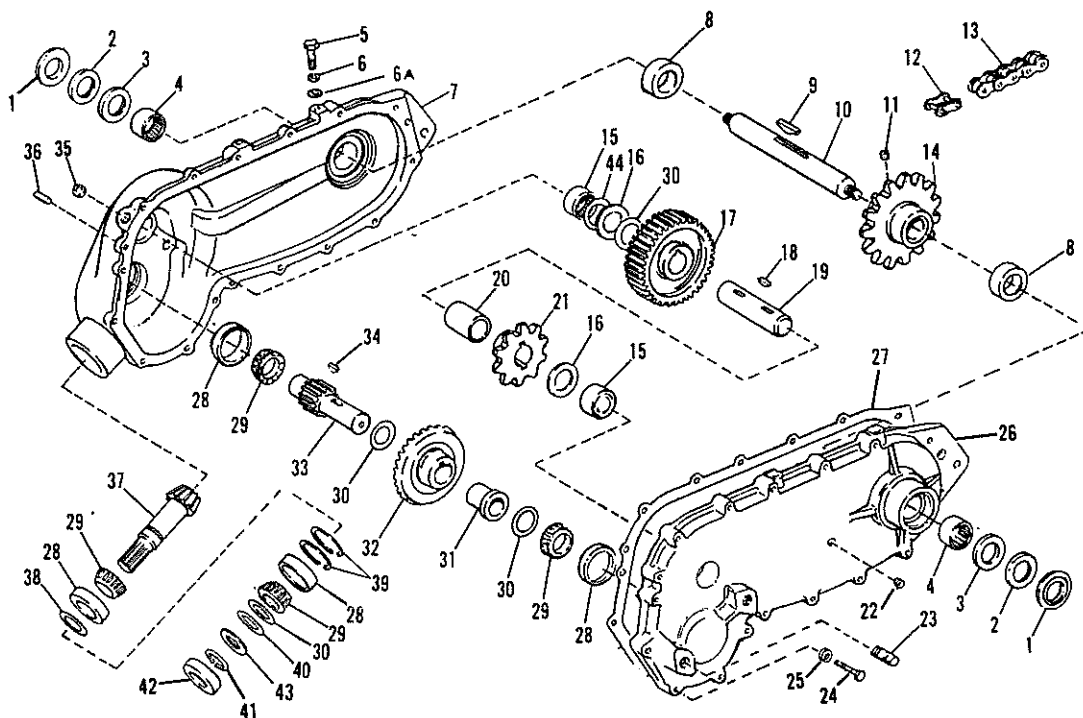


Fig. 8-12

# TILLERS

## GEAR CASE BREAKDOWN



- 1 Seal Washer
- 2 Oil Seal
- 3 Oil Seal
- 4 Needle Bearing
- 5 Capscrew
- 6 Lockwasher
- 6A Flat Washer
- 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 Sprocket, 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, 1/8 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
- 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