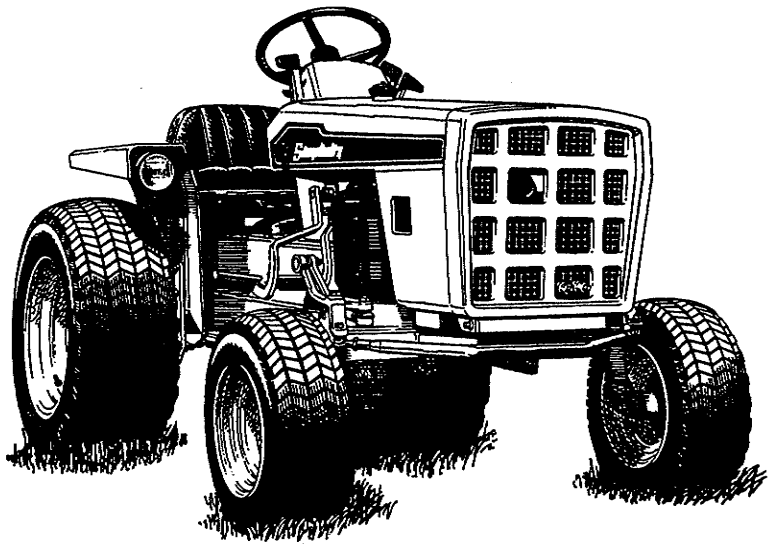
Simplicity®

This manual covers the following equipment:

Mfg. No.	Description	Mfg. No.	Description
990705	Pow'r Max Tractor - 4040	1690231	Model 720 Tractor (Allis Chalmers)
990953	Pow'r Max Tractor - 4041	1690283	Pow'r Max Tractor - 9020
990954	Pow'r Max Tractor - 4041	1690288	Model 720 Tractor (Allis Chalmers)
1690072	Pow'r Max Tractor - 9020	2020185	Model 616 Tractor (Allis Chalmers)
1690073	Model 720 Tractor (Allis Chalmers)	2020303	Model 620 Tractor (Allis Chalmers)
1690230	Pow'r Max Tractor - 9020	2020304	Model 620 Tractor (Allis Chalmers)



Pow'r Max Series Tractors

Repair Manual

4040-4041 & 9020 Pow'r Max Tractors

Also covers Allis Chalmers Model 616, 620, & 720 Tractors

(NOTE: This reprint contains all of the previous Volume 1 & Volume 2 in this one book.)

TP 500-0504-01-PM-SA

Table of Contents

General Information

BATTERY CARE 1-1
- BATTERY REMOVAL AND INSTALLATION 1-1
- WATER LEVEL 1-1
- CHARGING 1-2
- WINTER CARE 1-2

BEARING CLEANING AND INSPECTION 1-2
- CLEANING 1-2
- INSPECTION 1-2
- PRESERVATION 1-3
- TORQUE SPECS. FOR HARDWARE 1-3
- VISCOUS COATING VC-3 1-4
- DRYING 1-4

TRANSMISSION FLUID AND FILTER 1-4
- TRANSMISSION PRIMING PROCEDURE 1-4

BRAKE ADJUSTMENT 1-5

CLUTCH PEDAL FREE TRAVEL ADJUSTMENT 1-6

CLUTCH BELT TENSION 1-6
- REPLACEMENT PARTS 1-7

Tractor Repair

ENGINE 1-9
- DESCRIPTION 1-9
- ENGINE REMOVAL 1-9
- ENGINE DISASSEMBLY, REPAIR, AND ASSEMBLY 1-11
- ENGINE INSTALLATION 1-11

WHEELS AND DROP HOUSINGS 1-12
- REMOVAL AND INSTALLATION OF WHEEL 1-12
- REMOVAL AND DISASSEMBLY OF DROP HOUSING 1-12
- INSPECTION AND REPAIRS OF DROP HOUSING 1-13
- ASSEMBLY AND INSTALLATION OF DROP HOUSING 1-13

(Contents Continued)

Tractor Repair

BRAKES 1-14
- DESCRIPTION 1-14
- OPERATION 1-14
- REMOVAL AND DISASSEMBLY OF BRAKE ASSEMBLY 1-15
- DISASSEMBLY OF BRAKE LEVERS AND LINKAGE 1-16
- INSPECTION AND REPAIR 1-16
- ASSEMBLY OF BRAKE LEVERS AND LINKAGE 1-16
- INSTALLATION AND ASSEMBLY OF BRAKE ASSEMBLY 1-16

POWER TRAIN SYSTEM 1-18
- DESCRIPTION 1-18
- OPERATION 1-18
  1. CLUTCH 1-18
  2. HYDROSTATIC TRANSMISSION 1-18
  3. TRANSMISSION 1-19
  4. DIFFERENTIAL 1-21
  5. REAR PTO 1-21

CLUTCH 1-23
- CLUTCH DISASSEMBLY 1-23
- CLUTCH INSPECTION, CLEANING, AND REPAIR 1-24
- CLUTCH ASSEMBLY 1-24

DRIVE SHAFT 1-24
- DRIVE SHAFT REMOVAL 1-24
- DRIVE SHAFT INSTALLATION 1-24

TRANSMISSION 1-25
- TRANSMISSION REMOVAL AND DISASSEMBLY 1-25
- INSPECTION, CLEANING, AND REPAIR OF BEVEL GEAR TRANSMISSION 1-29
- TRANSMISSION ASSEMBLY 1-29
- TRANSMISSION INSTALLATION 1-31

DIFFERENTIAL 1-32
- DIFFERENTIAL REMOVAL AND DISASSEMBLY 1-32
- INSPECTION, CLEANING, AND REPAIR OF THE DIFFERENTIAL 1-32
- DIFFERENTIAL ASSEMBLY AND INSTALLATION 1-32

(Contents Continued)

Tractor Repair

REAR PTO 1-34
- DESCRIPTION 1-34
- PTO DRIVE UNIT REMOVAL 1-34
- PTO DRIVE UNIT DISASSEMBLY 1-35
- PTO DRIVE UNIT INSPECTION 1-36
- PTO DRIVE UNIT ASSEMBLY 1-37
- PTO DRIVE UNIT INSTALLATION 1-37
- REAR PTO DRIVE UNIT KIT 1-38

FINAL DRIVE 1-38
- DRIVE SHAFT ASSEMBLY REMOVAL AND INSPECTION 1-39
- INTERMEDIATE GEAR ASSEMBLY REMOVAL AND INSPECTION 1-39
- FINAL GEAR ASSEMBLY REMOVAL AND INSPECTION 1-40
- FINAL GEAR ASSEMBLY INSTALLATION 1-40
- INTERMEDIATE GEAR INSTALLATION 1-42
- DRIVE SHAFT ASSEMBLY INSTALLATION 1-43
- TRANSMISSION PRIMING PROCEDURE 1-43

STEERING AND FRONT AXLE ASSEMBLIES 1-44
- DESCRIPTION 1-44
- STEERING GEAR REMOVAL 1-44
- STEERING GEAR DISASSEMBLY 1-47
- STEERING GEAR INSPECTION 1-48
- STEERING GEAR REPAIRS 1-49
- STEERING GEAR ASSEMBLY 1-51
- STEERING GEAR BENCH ADJUSTMENT 1-53
- STEERING GEAR INSTALLATION 1-53
- STEERING SHAFT REMOVAL, INSPECTION, AND INSTALLATION 1-54
- DRAG LINK REMOVAL, INSPECTION, INSTALLATION AND ADJUSTMENT 1-56
- TIE ROD REMOVAL, INSPECTION, AND INSTALLATION 1-57
- HUB REMOVAL, INSPECTION, AND INSTALLATION 1-57
- SPINDLE REMOVAL, INSPECTION, AND INSTALLATION 1-58
- FRONT AXLE REMOVAL, INSPECTION, AND INSTALLATION 1-59

This notation preceding Cautions and Warnings in the text signifies important precautionary steps which, if not properly followed, could result in personal injury or damage to your equipment affecting safety.

Table of Contents
Tractor Repair

POWER LIFT SYSTEM 2-1
- DESCRIPTION 2-1
- FUNCTION 2-2
- HYDRAULIC CONTROL VALVE REMOVAL AND INSTALLATION 2-2
- HYDRAULIC CYLINDER REMOVAL 2-6
- HYDRAULIC CYLINDER INSTALLATION 2-6
- OIL COOLER REMOVAL, INSPECTION, AND INSTALLATION 2-6

ELECTRICAL SYSTEM 2-7
- DESCRIPTION 2-9
- GENERAL CHECKOUT PROCEDURES 2-9
- WIRING HARNESS 2-9
- BATTERY CIRCUIT 2-11
- BATTERY CONDITION 2-11
- BATTERY WIRING 2-12

CHARGING CIRCUIT 2-13
- DESCRIPTION 2-13
- CHARGING CIRCUIT CHECK 2-15
- NO CHARGE TEST 2-15
- HIGH CHARGE RATE TEST 2-15
- FLYWHEEL STATOR CHECK 2-15

IGNITION CIRCUIT 2-16
- DESCRIPTION 2-16
- IGNITION CIRCUIT CHECK 2-16
- SPARK PLUGS 2-16
- BREAKER POINTS AND CONDENSER 2-16
- COIL 2-17
- WIRING CIRCUIT 2-17

STARTING CIRCUIT 2-17
- STARTING CIRCUIT CHECK 2-17
- BATTERY AND BATTERY CIRCUIT 2-17
- WIRING CIRCUIT 2-17
- IGNITION CIRCUIT 2-17
- PTO SWITCH 2-19
- TRANSMISSION NEUTRAL START SWITCH ADJUSTMENT 2-20
- WIRING CIRCUIT CHECK 2-21
- ENGINE CRANKING REQUIREMENTS 2-21
- STARTING MOTOR AND SOLENOID CONDITION 2-21

LIGHTS AND HOURMETER CIRCUIT 2-21
- LIGHTS AND HOURMETER CIRCUIT CHECK 2-21
- BATTERY AND BATTERY CIRCUIT 2-21
- CHARGING CIRCUIT 2-21
- WIRING CIRCUIT 2-21
- IGNITION SWITCH 2-22
- LIGHT SWITCH 2-22
- WIRING CIRCUIT CHECK 2-22
- LIGHTS AND HOURMETER 2-22

(Contents Continued)

Tractor Repair

PRESSURE AND TEMPERATURE SENDING UNIT CIRCUIT 2-22
- PRESSURE AND TEMPERATURE SENDING UNIT CIRCUIT CHECK 2-22
- BATTERY AND BATTERY CIRCUIT 2-22
- CHARGING CIRCUIT 2-22
- WIRING CIRCUIT 2-22
- IGNITION SWITCH 2-22
- WIRING CIRCUIT CHECK 2-23
- WARNING LIGHTS 2-23
- SENDING UNITS 2-23

PTO CIRCUIT 2-24
- PTO CIRCUIT CHECK 2-24
- BATTERY AND BATTERY CIRCUIT 2-24
- CHARGING CIRCUIT 2-24
- WIRING CIRCUIT 2-24
- IGNITION SWITCH 2-24
- PTO SWITCHES 2-24
- WIRING CIRCUIT CHECK 2-24
- ELECTRIC CLUTCH 2-25

REMOVAL AND INSTALLATION OF ELECTRICAL COMPONENTS 2-25
- STARTER AND FLYWHEEL REMOVAL 2-25
- INSTRUMENT PANEL COMPONENT REMOVAL 2-25
- FRONT PTO CLUTCH REMOVAL 2-26
- FRONT PTO CLUTCH INSTALLATION 2-26
- CIRCUIT BREAKER REMOVAL AND INSTALLATION 2-27
- FUSE REMOVAL AND INSTALLATION 2-27
- TRANSMISSION NEUTRAL START SWITCH REMOVAL AND INSTALLATION 2-27
- LIGHT REMOVAL AND INSTALLATION 2-28
- SENDING UNIT REMOVAL AND INSTALLATION 2-28

TROUBLESHOOTING GUIDE 2-29

SPECIFICATIONS 2-30

FUEL SYSTEM 2-31
- DESCRIPTION 2-31
- SYSTEM OPERATION 2-31
- FUEL TANK AND FUEL GAUGE REMOVAL, INSPECTION, AND INSTALLATION 2-32
- AIR CLEANER REMOVAL, CLEANING, AND INSTALLATION 2-32
- FUEL LINES AND FILTER 2-35
- FUEL PUMP, CARBURETOR, GOVERNOR, MUFFLER, ETC. 2-36

(Contents Continued)

Tractor Repair

IN-LINE HYDROSTATIC UNIT 2-37
SPECIFICATIONS 2-37
HYDRAULIC FLUID RECOMMENDATIONS 2-37
SYSTEM DESCRIPTION 2-38
PUMP/MOTOR 2-38
CHARGE PUMP AND CHECK VALVES 2-38
CONTROL 2-38
IMPLEMENT RELIEF VALVE 2-39
ACCELERATION VALVES 2-39
TESTING 2-41
GENERAL 2-41
TEST PROCEDURE 2-41
TROUBLESHOOTING 2-43
REMOVAL AND INSTALLATION 2-45
GENERAL 2-45
REMOVAL 2-45
INSTALLATION 2-47
DISASSEMBLY, REPAIR AND REASSEMBLY 2-49
GENERAL 2-49
CHARGE PUMP 2-49
CHARGE RELIEF VALVE 2-50
IMPLEMENT RELIEF VALVE 2-51
ACCELERATION VALVES 2-51
SHAFT AND TRUNNION SEALS 2-51
MAJOR DISASSEMBLY AND REPAIR 2-51
SEPARATING THE (3) MAIN SECTIONS 2-51
MOTOR SECTION 2-51
PUMP SECTION 2-53
CENTER SECTION 2-54
REASSEMBLY 2-55
MOTOR SECTION 2-55
PUMP SECTION 2-55
CENTER SECTION 2-56
REASSEMBLING (3) MAIN SECTIONS 2-56
PRIMING PROCEDURE 2-57
TESTING AFTER REPAIR 2-57
EXPLODED VIEW 2-58
PARTS LIST 2-59

This notation preceding Cautions and Warnings in the text signifies important precautionary steps which, if not properly followed, could result in personal injury or damage to your equipment affecting safety.

Safety Rules

Attention Repair Personnel:

As repair personnel you have an obligation to know the product completely. This includes safety related aspects as well as the mechanical know-how. Before beginning repair, thoroughly familiarize yourself with the Operator's Manual for the product, paying particular attention to the safety warnings it contains. During repair it is possible to place yourself in a position which is more hazardous than when the unit is in full operation. Remember, it is your responsibility to repair a unit safety and then to be sure the unit is safe before it is again put into operation.

Preparation

- Read the Operator's Manual for the unit being repaired and the safety rules in this manual. Be thoroughly familiar with the controls and safe use of the unit.
- Keep the repair area clear of all persons, particularly small children, and pets.
- Have a clean, well lighted, ventilated area for repair work.
- Always wear heavy footwear and proper clothing. Never start or test run a power unit when wearing sandals or canvas shoes. During testing or adjustment never work near moving parts or wear loose fitting clothing.
- Never allow a child or inexperienced person to attempt the repair of a power unit.

Repair

- If a unit is to be lifted vertically for repair, follow the proper procedures for raising the unit given in this manual. If you do not have the proper lifting equipment, do not attempt to raise the tractor.
- Stop the engine, set the parking brake, and remove the key before working on a unit.
- Remove the spark plug wire and negative battery cable and fasten them away from any metal when working in the engine area.
- Block the wheels if a unit is to be jacked up and use jack stands. Never trust the jack alone to hold a unit.
- Follow all repair instructions in the exact order given in this manual.
- Handle gasoline with care – it is highly flammable. Your gasoline supply and any gas drained from a unit should be in approved containers.
- Check all nuts, bolts, and screws for tightness when repair is complete.
- After repair make sure:
  a. the unit is in operating condition,
  b. all safety devices and shields are in place and in working order, and,
  c. all adjustments have been made.

Test Operation

- Always follow the proper starting procedures for each unit as given in the Operator's Manual.
- If power unit starts to vibrate during testing stop the engine immediately. Check and correct the cause before restarting the engine.
- Be prepared for possible hazardous movement of the power unit or unit parts when testing the interlock and other safety device systems.
- Do not change engine governor settings or overspeed the engine.
- Never attempt to adjust any power unit while the engine is running.
- Keep hands and feet clear of all moving parts.
- Never test run a power unit indoors without a proper exhaust ventilation system and then only for short periods. Exhaust fumes are deadly.
- Be especially careful not to touch parts which might be hot from operation. Allow such parts to cool before readjusting or servicing.
- Never remove the fuel tank cap or add gasoline to a running or hot engine. Wipe up spilled gasoline.

General Information

BATTERY CARE

Battery Removal and Installation (Figure 1)

1. Open the tractor hood, disconnect the battery cover attaching springs, and remove the battery cover.

⚠ WARNING

The positive battery terminal can be easily shorted to the tractor frame by a metal tool. To avoid this problem, always disconnect the negative cable first and connect it last.

2. Remove the plastic caps from the battery terminals. Disconnect the battery cables, negative cable first, by removing the two capscrews securing the cables to the terminals.
3. Loosen the capscrews that secure the battery clamp and carefully remove the battery.
4. To install the battery, follow the battery removal procedure in reverse order. Make certain the positive cable is connected first. Check the condition of the cables and replace them if necessary.

Water Level

The battery water level should be checked every 25 hours of operation. Remove the battery cover and all battery caps, and check that the water level is up to the marking ring.

NOTE

Do not allow the water level in the battery to fall below the top of the plates.

Fill each battery cell to the marking ring with distilled water. If distilled water is not available, clean tap water may be used. Before replacing the battery caps, make sure the vent holes are free of dirt and grease. Make sure that the entire top of the battery is clean.

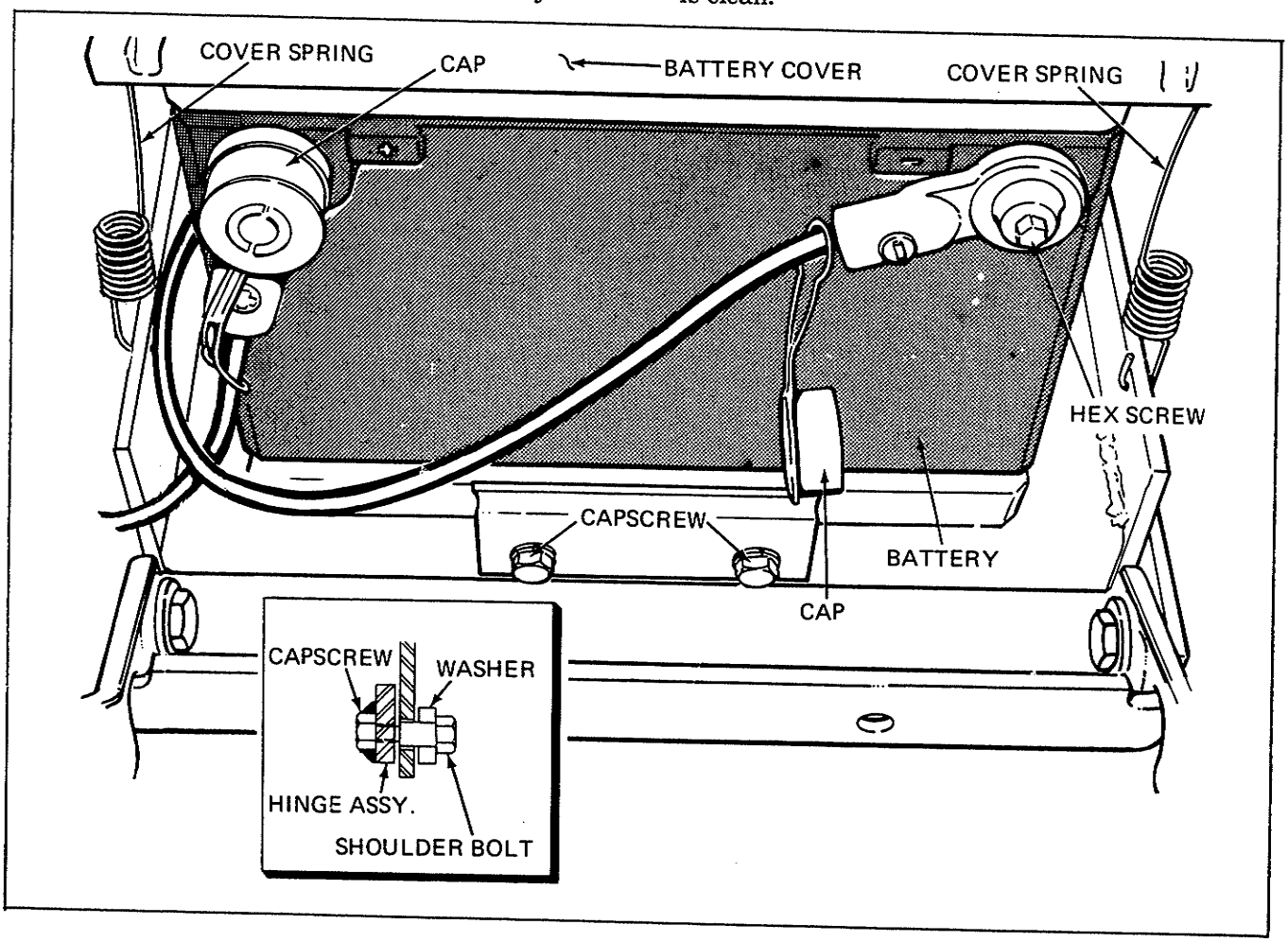


Figure 1. Battery Removal and Installation

Check the battery more often in warm weather. Water evaporates faster under high operating temperatures. When checking the battery water level, also check and make sure the battery posts, cables and connections are free from corrosion. Remove corrosion and clean the battery as required.

Charging

A hydrometer test of the battery solution should be made monthly. If the specific gravity is 1.225 or less, the battery should be removed and thoroughly recharged. If it is necessary to add water to the battery cells, it should be done just prior to recharging to mix the water thoroughly into the electrolyte solution.

An emergency charge at a high charging rate for a short period of time may be applied as a temporary measure to crank the engine. However, this supplies insufficient reserve to crank a second or third time. An emergency charge must be followed by a charging period sufficient to restore a full charge.

The following is the recommended rate and time needed to fully charge a completely discharged battery using a charger of 2450 watt rating.

Amperes	5	10
Hours	10	5

Winter Care

If the battery will not be used during the winter months, it should be removed fully charged and stored in a cool, dry place. Any collection of grease, dirt, or corrosion should be removed from the top of the battery and battery posts.

The battery should be recharged whenever the specific gravity of the battery is 1.225 or less. Before reinstalling the battery, it should be given a thorough recharge.

BEARING CLEANING AND INSPECTION

Cleaning

Do not try to determine the condition of a bearing until it has been cleaned. Solvents used for cleaning include naptha, kerosene, etc., but petroleum solvents made especially for washing parts are best.

Gasolines containing tetraethyl lead and other antiknock compounds are poisonous when inhaled or absorbed in cuts and should never be used.

⚠ WARNING

Fire precautions must be taken since nearly all these solvents are very flammable.

The containers used for cleaning should be deep, clean, and well filled with solvent. Bearings should never touch the bottom of the container where all the dirt settles.

Let the bearings soak long enough to loosen the grease and dirt. This may take several hours. Then, move the bearing around in the solvent near the top of the container. Turn the bearing slowly to expose all bearing parts. A short, high quality bristle brush can be used to aid in removing dirt and grease.

After all visible dirt is removed, rinse the bearing in a clean container of clean solvent, dry and immediately dip the bearing in oil or light grease before inspecting.

⚠ WARNING

Do not spin bearings with compressed air. A dry bearing spun at high speeds will be damaged, and if a piece of dirt or steel flies off at high speed, someone could be injured.

If a bearing is dried with compressed air, rotate one ring slowly by hand to expose all parts of the bearing.

Bearings with a shield or seal on one side only, or removable seals, can be cleaned, inspected and handled in the same way as bearings without shields or seals. Bearings with permanent seals or shields on both sides must not be washed, but instead, should be wiped carefully to keep dirt out. If sealed bearings turn smoothly and are not otherwise damaged, coat the outside with grease and wrap them in grease-proof paper to keep them clean. If they stick or turn roughly, replace them.

Inspection

After cleaning the bearings, inspect them to determine if they may be placed in service again.

NOTE

If one bearing on a shaft fails, it is a good practice to replace the second one also, even if no visible damage occurred.

A little tarnish, stain or corrosion on the outside edge of the races is not harmful to bearing operation and it need not be removed. Cleaned bearings that cannot be separated can be inspected by holding the bearing horizontally and turning the outer race slowly. Any bearing which sticks, runs roughly or makes a clicking noise should be recleaned and turned again. If the condition still exists, replacement is necessary.

External visual inspection should reveal whether the bearings have broken or cracked races, dented seals or shields, cracked or broken separators, balls, or rollers and whether the bearing has been overheated, which will be indicated by a brownish-blue or blue-black color. If any of these conditions exists, replacement is necessary.

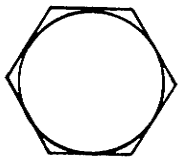
Separable bearings should be inspected for flecked, pitted, or scratched areas on the balls, rollers, and races, and for indenting of the races. If any of these conditions exist, replacement is necessary. No accurate field inspection for excessive "end shake" exists. Unless it is known that a given bearing has none, only a visual comparison with a new bearing is possible. If excessive end shake is suspected, replace the bearing, even if no visible damage is present. Wear can occur which is not visible, especially if fine abrasives have mixed with the lubricant.

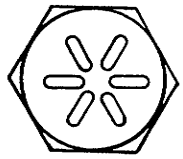
Preservation

After inspection, the bearings should be greased or oiled immediately. If the cleaned, reusable bearings are not going to be installed within a few hours after cleaning, they should be wrapped in clean, grease proof paper and placed in a clean box or container.

RECOMMENDED TORQUE SPECS. FOR HARDWARE

THESE SPECIFICATIONS APPLY TO PLATED HARDWARE





SIZE	SAE GRADE NO. 2	SAE GRADE NO. 5	SAE GRADE NO. 8
8-32	19" In./Lbs.	30" In./Lbs.	41" In./Lbs.
8-36	20" "	31" "	43" "
10-24	27" "	43" "	60" "
10-32	31" "	49" "	68" "
1/4-20	66" "	8" Foot/Lbs.	12 Foot/Lbs.
1/4-28	76 "	10 "	14 "
5/16-18	11 Foot/Lbs.	17 "	25 "
5/16-24	12 "	19 "	25 "
3/8-16	20 "	30 "	45 "
3/8-24	23 "	35 "	50 "
7/16-14	30 "	50 "	70 "
7/16-20	35 "	55 "	80 "
1/2-13	50 "	75 "	110 "
1/2-20	55 "	90 "	120 "
9/16-20	65 "	110 "	150 "
9/16-18	75 "	120 "	170 "
5/8-11	90 "	150 "	220 "
5/8-18	100 "	180 "	240 "
3/4-10	160 "	260 "	386 "
3/4-16	180 "	300 "	420 "
7/8-9	140 "	400 "	600 "
7/8-14	155 "	440 "	660 "
1-8	220 "	580 "	900 "
1-12	240 "	640 "	1,000 "

Figure 2. Recommended Torque Specifications

Viscous Coating VC-3

Viscous coating VC-3 must be dry to lock. It should be applied prior to assembly and dried. The hardware will then lock immediately at installation. If hardware must be assembled wet, a delay of 24 hours must be expected before locking will occur.

NOTE

Any bolt that goes directly thorugh the transmission case must be coated with VC-3. You cannot use permatex as it will leak due to the pressure of the case. Only VC-3 or comparable sealer can be used on this hardware.

Drying

Hardware coated with VC-3 can be dried in a hot oven. The approximate drying time at 250 degrees to 300 degrees F. is 3 minutes and 10 minutes at 200 degrees F.

VC-3 requires 6 to 24 hours to dry when no heat is applied. Large areas require more time to dry.

TRANSMISSION FLUID AND FILTER

The transmission fluid and transmission filter should be changed every 400 hours. The filter should also be changed whenever the transmission case is drained and refilled with transmission fluid.

To change the transmission fluid and transmission filter, use the following procedure.

NOTE

Warm fluid will drain best. Run the engine for 5 minutes before starting this procedure.

1. Park the tractor on a level surface, stop the engine and set the parking brake.
2. Remove the bottom cover from the tractor frame.
3. Disconnect the hydrostatic pump inlet hose from the elbow on the transmission case and the electrical connection from the transmission temperature sending unit (Figure 111, page 2-46).
4. Place a suitable container under the transmission case, and remove the dipstick assembly, elbow and temperature sending unit allowing the transmission oil to drain from the case. Raise the back of the tractor to get as much of the fluid out as possible. After the oil has completely drained, install the elbow and temperature sending unit, attach the inlet hose to the elbow and connect the transmission temperature sending unit's electrical connection.
5. Remove the oil filter by turning it counterclockwise. Wipe the sealing surface of the mounting bracket clean.
6. Place a film of transmission oil on the filter sealing gasket. Install and hand tighten the new filter by turning it clockwise. The new filter should be a PER-17-1, 25 micron (Simplicity part no. 1650954).
7. Fill the transmission case through the dipstick opening with approximately six quarts of Type A, Type F, or Dexron automatic transmission oil. Pour slowly and check the level often with the dipstick until the level reaches the full mark. Install the dipstick.
8. Install the bottom cover.
9. Prime the hydrostatic system.

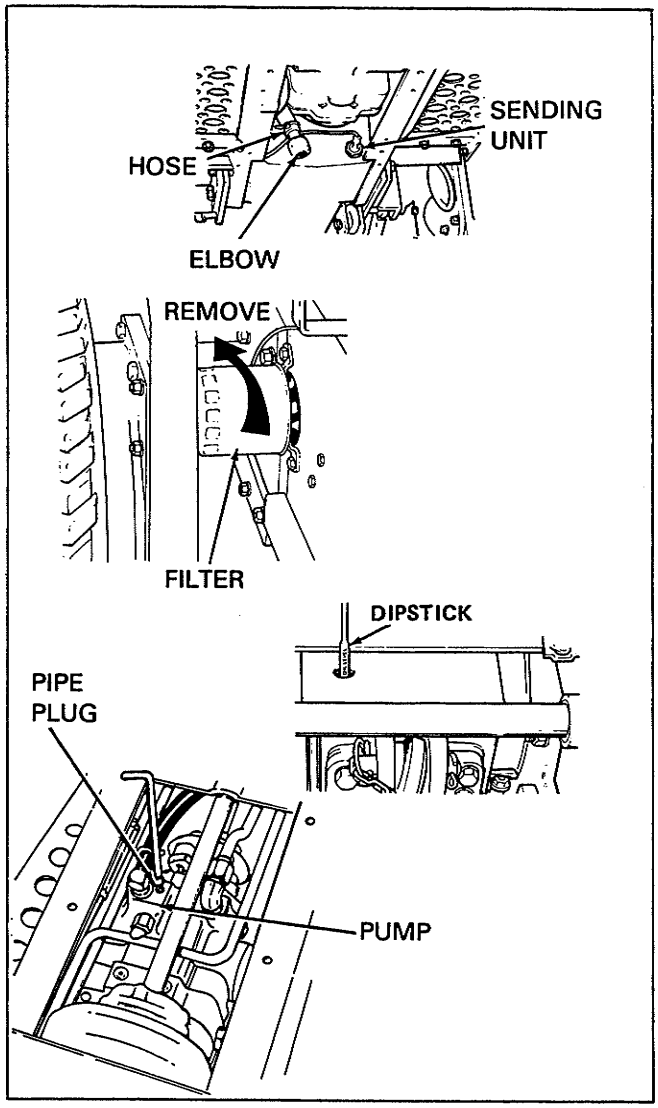


Figure 3. Transmission Fluid and Filter

Transmission Priming Procedure (Figure 3)

1. Disconnect the B+ lead from the ignition coil and two spark plug wires.
2. Remove the cover assembly from the center console of the tractor.
3. Remove the pipe plug from the pump. Pour transmission oil through the pipe plug hole, while cranking engine, until it overflows (see Figure 3).
4. Crank the engine using the battery until fluid flows from the pipe plug hole with no air bubbles. You may have to stop and add oil several times. Wipe up all spills.
5. Install the pipe plug and the cover assembly. Reconnect the B+ lead to the ignition coil.
6. Run the engine for a short period and check the oil level in the transmission case. Add transmission oil if necessary.
7. It is recommended that a charge pump pressure reading and an implement reading be taken at this time. To do this, insert a pressure gauge which reads more than 1000 psi into the pipe plug hole (see Figure 3). A charge pump reading is taken by running the engine at 3/4 to full RPM which should give a reading of 50-150 psi. For the implement reading, keep engine at same RPM, and pull lever rearward, which should give a reading of 550-800 psi.

BRAKE ADJUSTMENT (Figure 4)

The left and right brakes must be adjusted and checked one at a time. To check the brakes, retract the brake lock pin, and separate the two pedals. Then measure the distance the left brake pedal can be moved easily by hand. This distance should be 1-1/4 inches. To check the right brake pedal, lock the left pedal in the fully depressed position; then depress the right brake pedal. It should be even with the left brake pedal. If either check fails, use the following procedure to adjust the brakes.

1. Remove the cover plate assembly.
2. Loosen the locknuts at both ends of the brake turnbuckle.
3. Rotate the turnbuckle counterclockwise, as viewed from the rear of the tractor, to decrease the measurement made during the check, and rotate it clockwise to increase the measurement.
4. Repeat the measurement check and, if needed, the adjustment. When check shows the correct measurement, hold the turnbuckle and tighten both locknuts securely.

NOTE

If you cannot set the parking brake after making the adjustment, loosen the turnbuckle slightly.

5. Install the cover plate assembly.

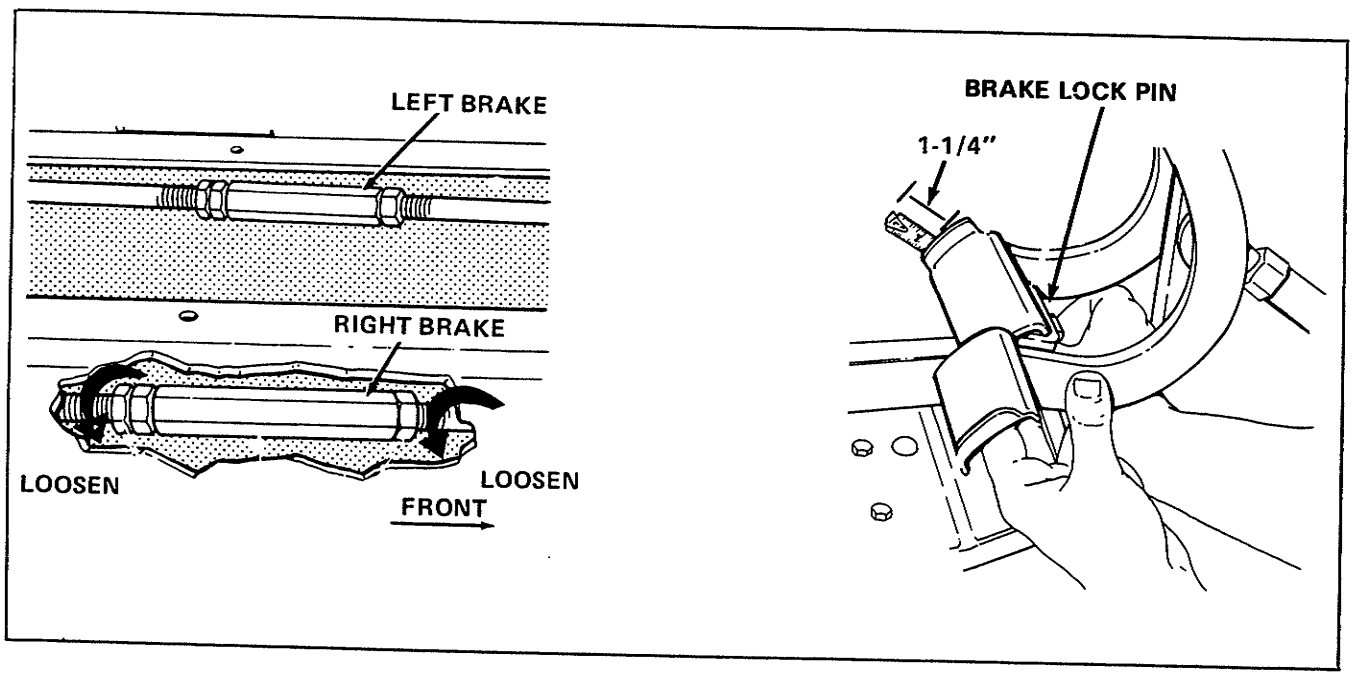


Figure 4. Brake Adjustment

CLUTCH PEDAL FREE TRAVEL ADJUSTMENT (Figure 5)

Check the clutch free travel after running the engine for 5 to 10 minutes. Measure the distance you can move the clutch pedal easily by hand. This distance should be 1 to 2 inches. If it is not, use the following procedure to adjust the clutch free travel.

NOTE

Make sure the engine is turned off, the key is removed from the ignition switch, and the parking brake is set.

1. Remove the bottom cover from the tractor frame.
2. Turn the locknut clockwise to decrease free travel or counterclockwise to increase free travel (Item H in Figure 5).
3. Repeat the measurement check and locknut adjustment until free travel is correct.
4. Install the bottom cover.

CLUTCH BELT TENSION (Figure 5)

If the clutch belt tension is not adjusted correctly, the clutch belts will slip when the clutch is engaged (clutch pedal released) or continue to drive when the clutch is disengaged. If either of these conditions occurs, use the following procedure to adjust the clutch belt tension.

1. Run the engine for 5 to 10 minutes. Then stop the engine, remove the key and set the parking brake.
2. Raise the hood and oil cooler.
3. Remove the two capscrews and four washers mounting the oil cooler. Carefully lift the oil cooler up and toward the right side of the tractor making certain not to break the transmission oil hose connections. Handle the oil cooler with care.
4. Use a ruler to check the length of the clutch belt tension spring from the top of the bracket to the bottom of the hex cap. This dimension with the clutch pedal released and returned to its engaged position should be 7-3/4 inches. If not, rotate hex cap to obtain the correct dimension. If the proper spring length cannot be obtained in this manner, remove the hex cap and spring. Then adjust the position of the two jam nuts at the bottom end of the spring so the gap between the two pulleys is 1/8 to 3/16 of an inch when the clutch pedal is depressed. Reinstall the spring and hex cap and recheck the spring length.

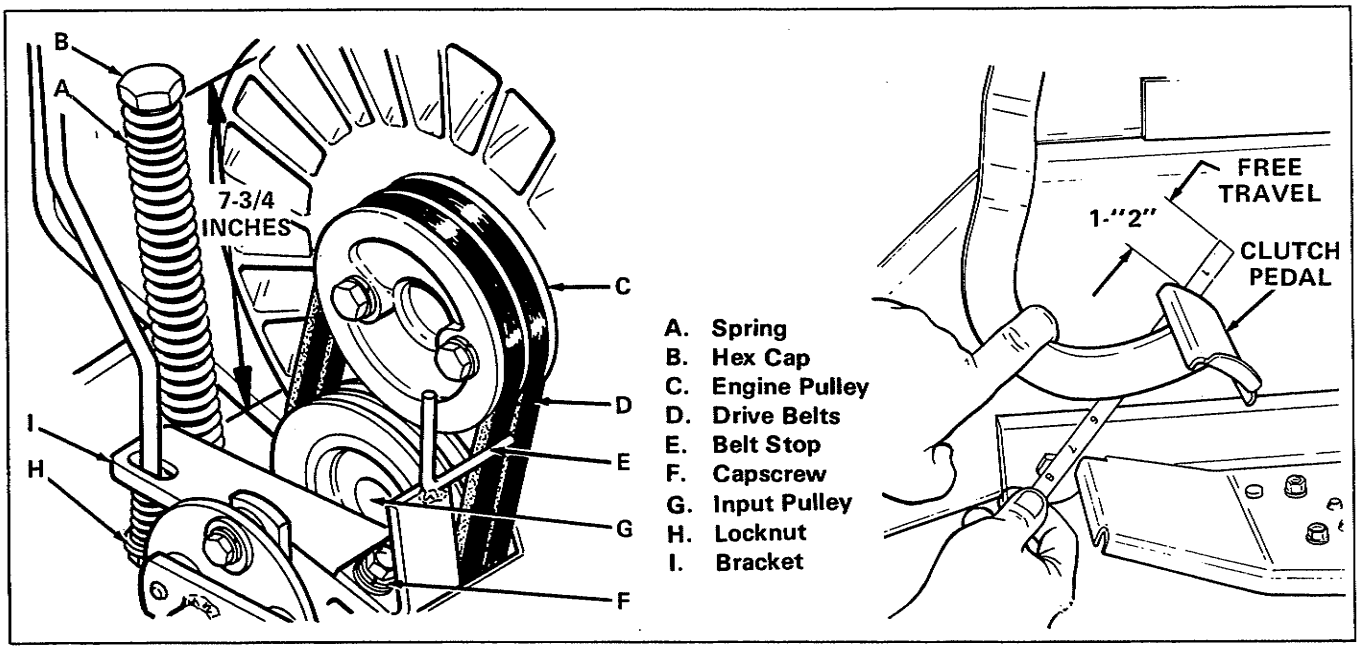


Figure 5. Clutch Pedal Free Travel Adjustment and Clutch Belt Tension

5. Measure the gap between the drive belt and the belt stop. This gap should be 1/16 to 1/8 of an inch. If not, loosen the capscrew and move the belt stop to correct the gap. Retighten the capscrew.
6. Check and, if necessary, adjust the clutch free travel.
7. To reinstall the oil cooler, loosely install one capscrew and metal washer on the right side. On the left side, place one rubber washer above the cooler and the other below it, and loosely attach them with the remaining capscrew and metal washer. Carefully push the oil cooler down so it is firmly seated and tighten both capscrews.

REPLACEMENT PARTS

Refer to the respective Manufacturing and Serial Number parts catalogs for recommended replacement parts.

DISASSEMBLY INSTRUCTIONS

Throughout this service manual, disassembly procedures specify the complete disassembly of components. Therefore it is necessary for discretion to be used when following the text so that items which need not be disassembled are not disassembled. It is recommended that you familiarize yourself with the procedures in this manual before attempting disassembly.

Tractor Repair

ENGINE

Engine Description

The power unit on the 4040 tractor is a CCKA-16-1/2 horsepower engine, and the power unit on the 4041, Pow'r Max, and 9020 tractors is a CCKB-19-1/2 horsepower engine. Both are two cylinder, four cycle, air cooled engines manufactured by Onan. Refer to the Onan service manual for additional specifications.

Engine Removal

1. To remove the tractor hood on a 4040 tractor, open the hood and remove the two hairpin clips from the pivot rod. Support the hood and slide the pivot rod from the hinge.

   To remove the tractor hood on all other models, remove the two shoulder bolts and washers holding the hood to the hinge assembly (Figure 1). Remove the hood from the tractor.

2. Remove the battery. Refer to Battery Removal and Installation under General Information.

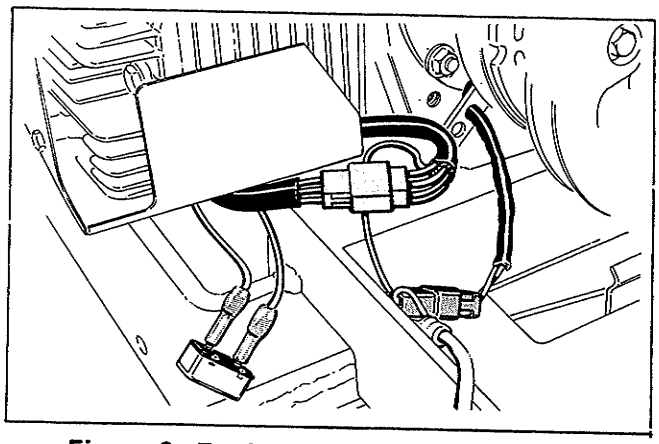


Figure 6. Engine Electrical Connections

3. Disconnect the circuit breaker, front clutch and main harness electrical connections at the right front side of the engine (Figure 6).
4. Remove the spring clip from the choke cable and the clamp from the throttle cable (Figure 7). Loosen the governor control swivel screw on the engine. Then, disconnect the cables.
5. Disconnect the rubber fuel lines at the fuel tank. Do not open the hose clamps any further than necessary.

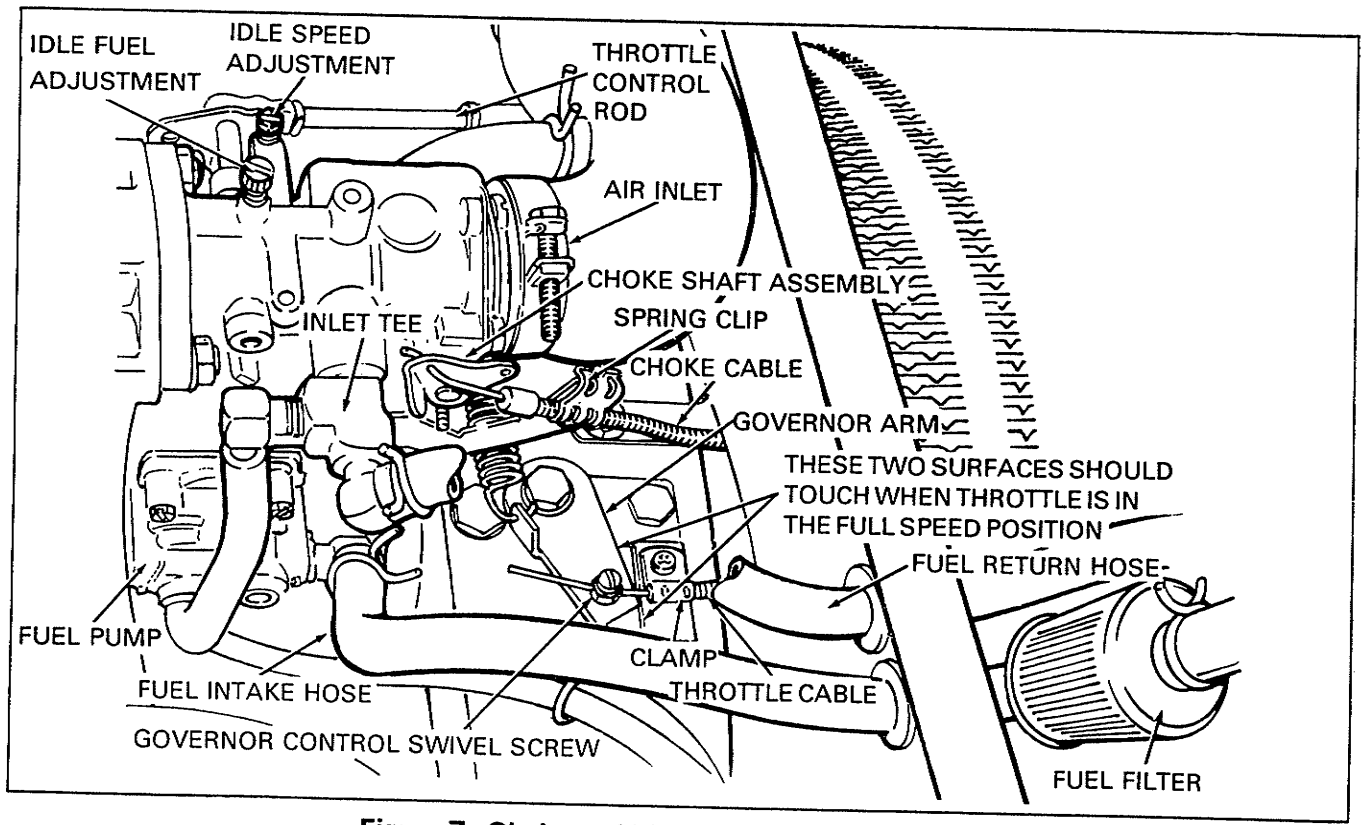


Figure 7. Choke and Throttle Cable Connections

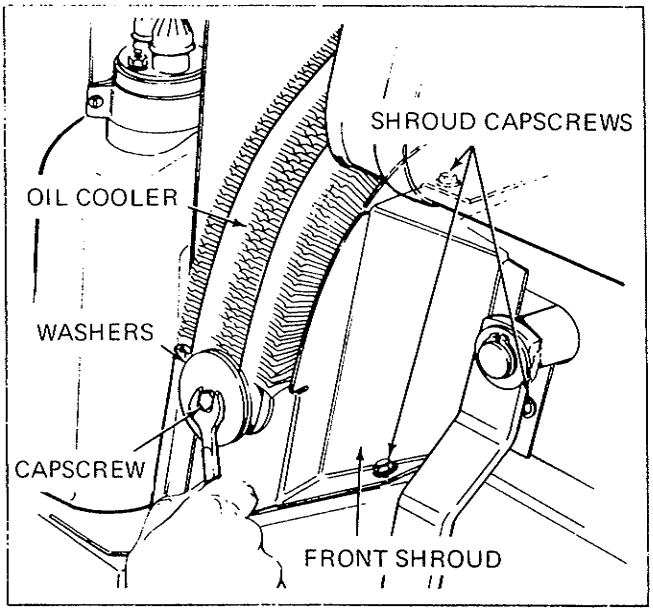


Figure 8. Oil Cooler and Shroud Removal

6. Remove the two capscrews and four washers mounting the oil cooler (Figure 8). Carefully lift the oil cooler up and toward the right side of the tractor making certain not to break the transmission oil hose connections. Handle the oil cooler with care.
7. Remove the four capscrews securing the left and upper engine shrouds (Figure 8) and remove the shrouds.
8. To disconnect the rear PTO, remove the two 3/8-16 x 3-1/2 inch long capscrews, washers and spacers used in securing the PTO coupling to the engine flywheel. Refer to PTO drive unit removal, page 1-34.
9. Tie the clutch pedal to the axle (Figure 9) and remove the two matched V-belts from the engine and clutch pulleys.
10. Remove the bottom frame cover.

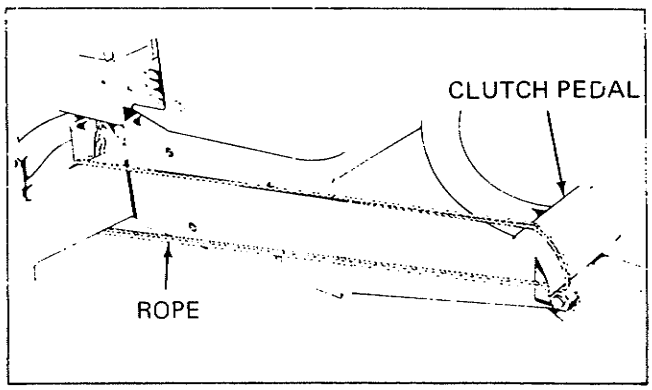


Figure 9. Tieing Clutch Pedal

11. Remove the three 7/16-14 x 1-1/2 inch long capscrews, washers and nuts securing the engine to the frame (Figure 10). If it is provided, remove the 3/8-16 x 1 inch long taptite screw through the right hand rear engine mounting hole.

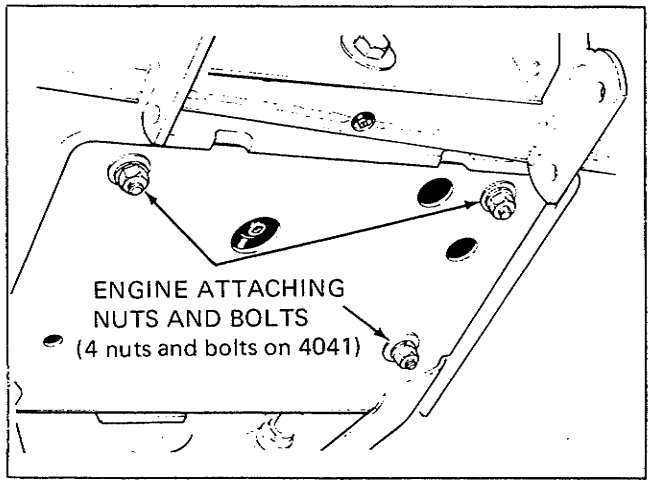


Figure 10. Engine Attachment

12. Place a belt or rope around the engine rear pulley and the front PTO housing. Then using a hoist, remove the engine from the tractor (Figure 11).

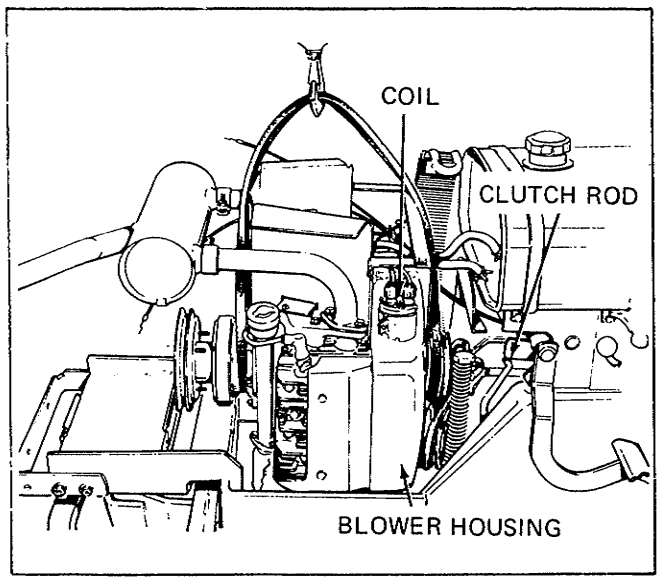


Figure 11. Engine Removal and Installation

⚠ CAUTION

Take care not to damage the front PTO wiring.

Engine Disassembly, Repair and Assembly

(Refer to Onan service manual)

Engine Installation

1. Position engine on tractor using care not to damage electrical wires with hoist (Figure 11). Loosely secure the engine to the frame with the attaching hardware.
2. Pull the engine forward against the mounting bolts. This will align engine with the PTO drive shaft. Torque the mounting bolts to 20 foot-pounds.
3. Install rear PTO.
   a. Loosely attach PTO coupling, through the upper pulley, to the engine flywheel with the two 3/8-16 x 3-1/2 inch long capscrews, washers and spacers. Apply Loctite to the capscrews before installation.
   b. Use a dial indicator to check the runout near the splined front end of the PTO shaft (see Figure 11A). If runout exceeds 0.020 of an inch, reposition the shaft by tapping yoke until the runout falls below 0.020.

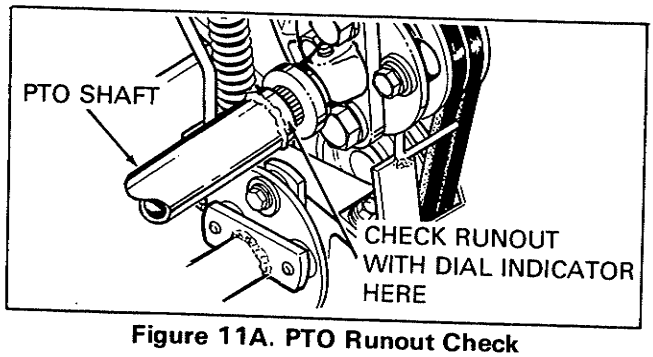


Figure 11A. PTO Runout Check

   c. Torque the capscrews attaching the PTO coupling to the engine flywheel at 25-30 foot-pounds.

⚠ CAUTION

Torquing over 30 foot-pounds may strip the threads in the flywheel.

   d. Lubricate the shaft through the grease fitting on the yoke with general purpose automotive grease.

4. Check the clutch pedal free travel measurement and adjust it if necessary. Refer to Clutch Pedal Free Travel Adjustment under General Information.
5. Secure bottom cover to frame.
6. Check the condition of both pulley belts. If the rubber is hard, cracked, or frayed, replace the belts. Tie the clutch pedal to the axle (Figure 9) and work both belts onto the engine and clutch pulleys. Make sure they are firmly seated. Check the clutch belt tension and adjust it if necessary. Refer to Clutch Belt Tension under General Information.
7. Install the left and upper engine shrouds.
8. To reinstall the oil cooler, loosely install one capscrew and metal washer on the right side. On the left side, place one rubber washer above the cooler and the other below it and loosely attach with the remaining capscrew and metal washer. Carefully push the oil cooler down so it is firmly seated and tighten both capscrews.
9. Check the condition of the fuel lines. If the rubber is hard or cracked, replace the defective hose. Connect the rubber fuel lines at the fuel tank.
10. Attach the throttle and choke cables to carburetor using the spring clip for the choke cable and the clamp for the throttle cable. Tighten the governor control swivel screw so the governor arm touches the throttle cable clamp mounting bracket on the engine (Figure 7).

NOTE

If the governor arm contacts the mounting bracket before the throttle control is at the full position, the engine will not idle properly. If the governor arm does not contact the mounting bracket when the throttle control is at the full position, full rpm will not be obtained.

11. Connect the circuit breaker, front clutch and main harness plug at the right front side of the engine. Check the condition of the wiring and replace if necessary.

NOTE

Clean and replace spark plugs. Install new plugs every 100 hours (Champion H-8, or equivalent). Plug gap must be set at 0.025 of an inch.

12. Install the battery. Refer to Battery Removal and Installation under General Information.
13. Attach the tractor hood to the hinge assembly by using the two shoulder bolts and washers (Figure 1).

WHEELS AND DROP HOUSINGS;

Removal and Installation of Wheel

1. Remove any or all wheels.
   a. Using an appropriate jack, raise the tractor to the required height for wheel removal and support the frame on a suitable stand.
   b. Remove the six 9/16-18 wheel bolts to remove a rear wheel or five 7/16-20 wheel nuts (bolts on 4040 and 4041) to remove a front wheel (Figure 12).
2. Install any or all wheels.
   a. When installing a rear wheel, attach to axle with the six 9/16-18 wheel bolts and torque them to 60-70 foot-pounds. When installing a front wheel, attach to axle with the five 7/16-20 wheel nuts (bolts on 4040 and 4041) and torque them to 40-50 foot-pounds.
   b. Carefully lower the tractor from the stand.

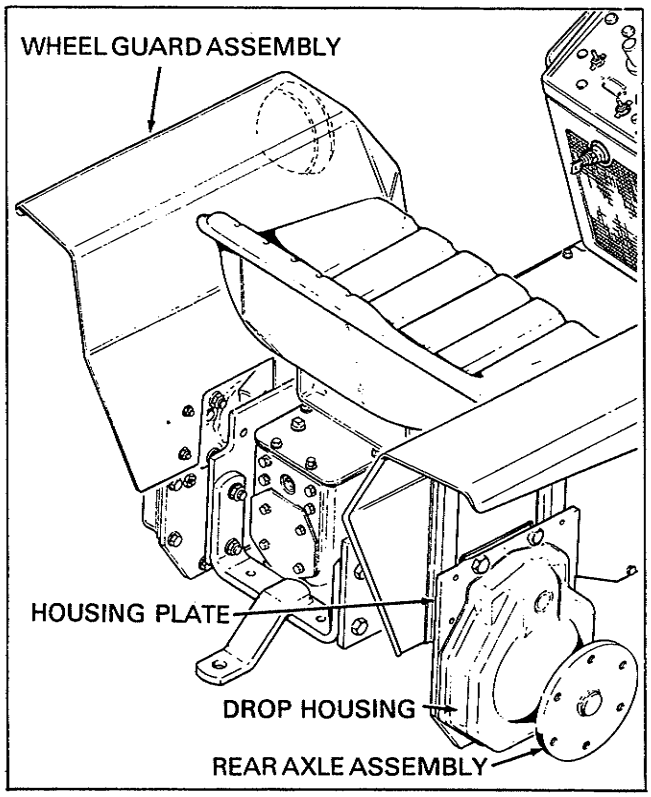


Figure 12. Wheel Guard, Drop Housing, and Rear Axle Group

Removal and Disassembly of Drop Housing

1. Remove drop housing.
   a. Remove wheel. Refer to Wheels and Drop Housings for removal procedures.
   b. Remove the wheel guard by removing the four capscrews, lockwashers and nuts holding it to the drop housing plate (Figure 13).
   c. Remove the two 1/2-13 x 1 inch long and the two 1/2-13 x 1-1/2 inch long capscrews and nuts holding the drop housing and housing plate to the axle extension (Figure 13), and remove the two 5/16-18 inch long capscrews, washers, and nuts securing the wheel guard to the foot rest.
   d. Carefully move the drop housing away from the axle extension so the bull pinion comes straight out of the differential shaft coupling. Remove the spring from the pinion. Make sure the axle coupling remains on the differential shaft.
   e. Place the drop housing over a suitable container and remove the drop housing drain plug to allow the oil to drain into the container.

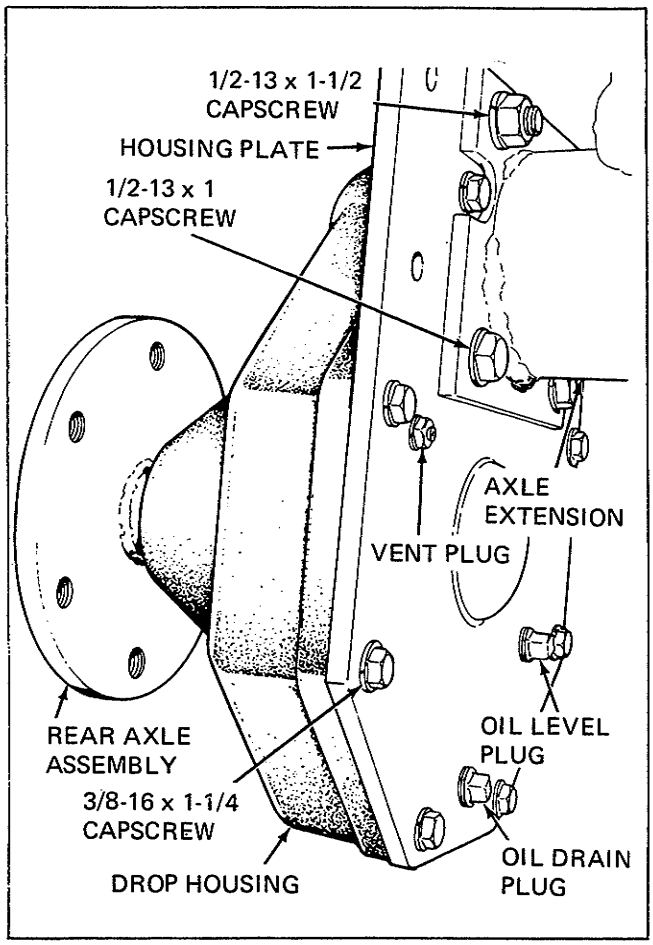


Figure 13. Drop Housing Removal and Installation

2. Disassemble drop housing.
   a. Remove the eight 3/8-16 x 1 inch long capscrews and lockwashers holding the drop housing to the housing plate (Figure 13).
   b. Use a soft-headed mallet to tap the plate loose from the housing. Remove the gasket and o-rings from the housing plate.
   c. Drive the bull pinion assembly from the drop housing plate using a soft-headed mallet (Figure 14). Remove the thrust washer from the housing.
   d. If the bearing must be removed from the bull pinion assembly, place the bull pinion assembly in a press, and using the press, drive the bull pinion from the bearing. Remove the slinger.
   e. If the roller bearing (Figure 15) must be removed for replacement, use a suitable tool.
   f. Place the rear axle assembly carefully in a vise and remove the locknut and washer (Figure 15).
   g. Slide the bull gear off the rear axle assembly's shaft and pull the shaft through the drop housing (Figure 15). Remove the oil seal from the housing.
   h. Remove the inner and outer taper roller bearings (Figure 15). The bearing cups are pressed into the housing and need not be removed except for replacement.

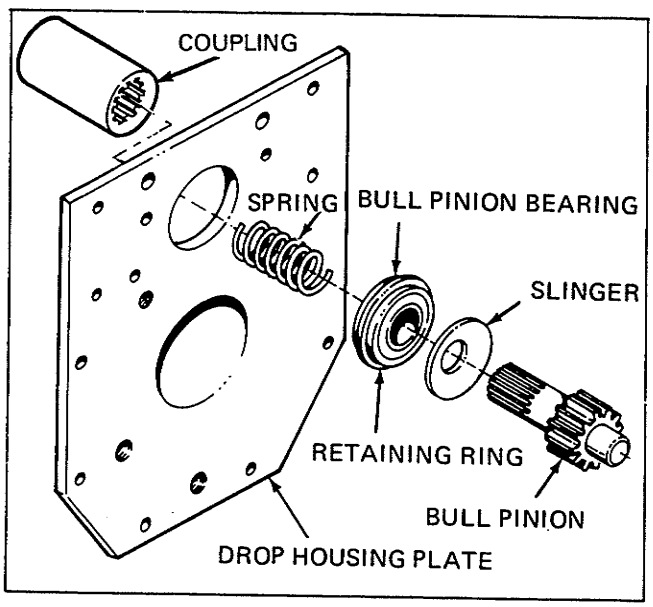


Figure 14. Bull Pinion Assembly

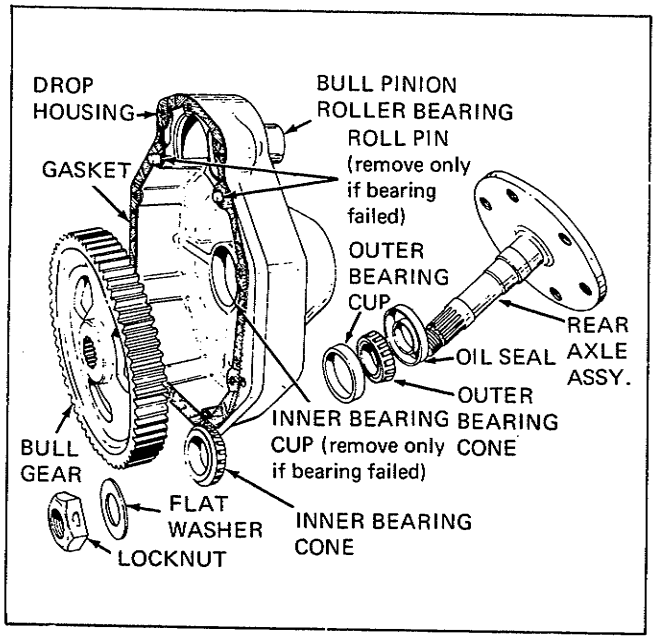


Figure 15. Rear Axle Assembly

Inspection and Repairs of Drop Housing

1. Wash all parts in cleaning solvent and dry with compressed air. Do not spin bearings with compressed air.
2. Check bearings for looseness, wear, roughness, pitting or scoring. Replace them if necessary. Refer to Bearing Cleaning and Inspection under General Information.
3. Check all gears and shafts for wear and burrs. Replace all damaged parts.
4. Replace all gaskets, oil seals and o-rings.
5. Replace any damaged or worn retainer rings.

Assembly and Installation of Drop Housing

1. Assemble drop housing.
   a. Use a soft-headed mallet and driver to evenly tap the bearing cups into the drop housing (Figure 15).
   b. Dip the outer bearing cone in SAE 90 transmission oil and install it in the housing. Install a new oil seal in the housing.
   c. Insert the rear axle assembly shaft into the drop housing and seat the outer bearing cone in its cup (Figure 15).

d. Slide the bull gear on the rear axle assembly shaft and secure it with the washer and locknut (Figure 15). Torque the nut to 1 to 2 foot-pounds. Then turn the shaft to check for ease of operation. Rolling torque on the axle should be checked to take 12 inch-pounds

NOTE

Rolling torque is the effort required to rotate the axle and gear assembly relative to the housing. Rolling torque will increase as the bull gear locknut is tightened and decrease as the locknut is loosened.

e. Dip the bull pinion gear in SAE 90 transmission oil.

f. If the bull pinion gear bearing was removed, insert the bull pinion shaft through the slinger and bearing (Figure 14). Make sure the slinger's disk side and the retaining ring are toward the gear. Coat the outside dimension of the bearing with viscous coating VC-3. Press the assembly into the housing plate.

g. Install new o-rings and gasket on the housing. Install the thrust washer on top of the needle bearing.

h. Secure the drop housing to the housing plate with the eight 3/8-16 x 1 inch long capscrews and lockwashers (Figure 13).

2. Install drop housing.

a. Place the spring on the bull pinion shaft and insert the shaft into the axle coupling.

b. Secure the drop housing plate to the axle extension with the two 1/2-13 x 1 inch long and the two 1/2-13 x 1-1/2 inch long capscrews and nuts.

c. Secure the wheel guard with the six capscrews, lockwashers and nuts.

d. Install wheel. Refer to Wheels and Drop Housings for installation procedures.

e. Install the oil drain plug in the drop housing plate and remove the oil level plug. Add 16 ounces of SAE 90 transmission oil through the plug opening to the level of the threads. Reinstall the oil level plug.

BRAKES

Description

The brakes are individual, high capacity, self-energizing, double disc brakes located on the differential output shafts. The parking brake lock control is located on the left side of the tractor and used to lock the brakes in position after the tractor has been brought to a stop.

Operation (Figure 16)

When the foot brakes are depressed, the brake linkage activates the brake assemblies and the actuating discs separate on three balls which press on inner and outer rotating discs that are splined to the differential output shaft. Each rotating disc is compressed between the stationary actuating disc and the inner and outer stationary discs that are secured by three studs to the transmission case. This compression slows or brakes the differential output shaft.

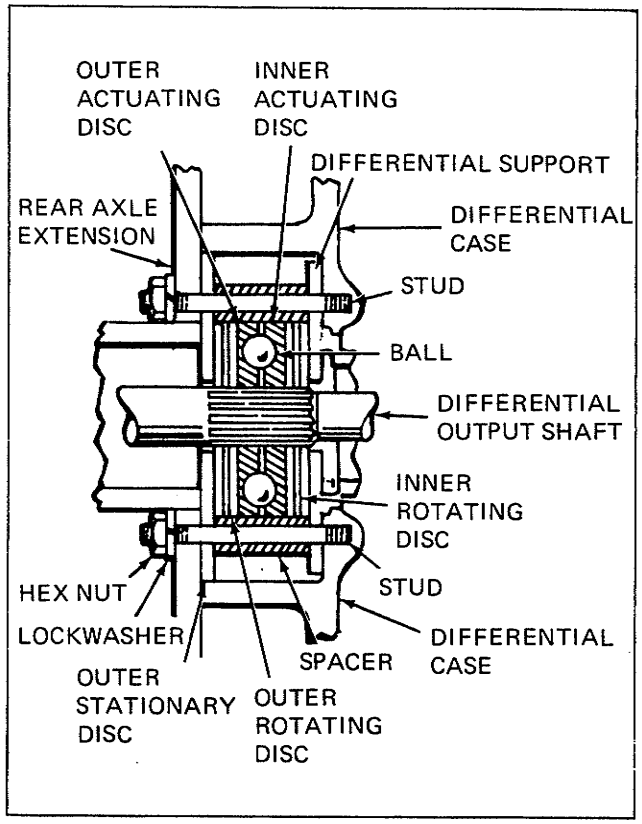


Figure 16. Disc Brake Operation

Removal and Disassembly of Brake Assembly

1. Remove the brake assembly.
   a. Remove any rear or center mounted attachment.
   a. Remove wheel and drop housing. Refer to Wheels and Drop Housing for removal procedures.
   c. Disconnect and remove the lift cylinder from the left rear axle extension and lift arm assembly by removing the attaching hairpin clips and pins. Carefully place the cylinder out of the way and take care not to bend the hoses excessively or put a strain on the connections.

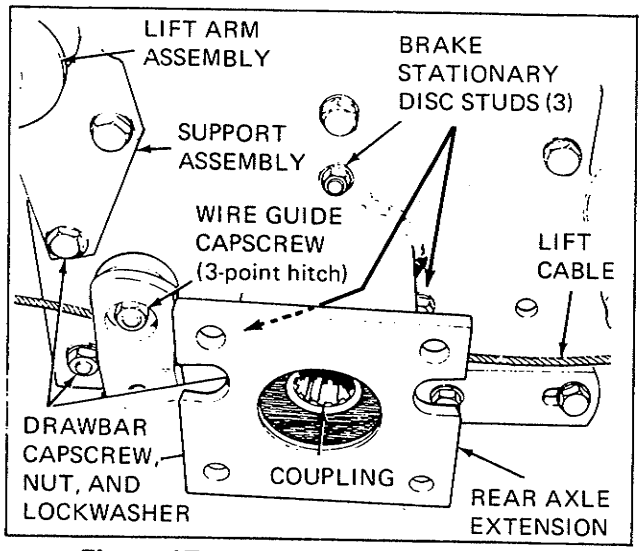


Figure 17. Right Rear Axle Extension

   d. Remove the two 1/2-13 x 1-1/2 and two 1/2-13 x 1-3/4 inch long capscrews and nuts holding both support assemblies to the axle extensions (Figure 17). Remove the wire guide from the axle extensions.
   e. Remove the draw bar by removing the two 1/2-13 x 1-1/2 long capscrews, lockwashers and nuts holding it to the axle extensions (Figure 17).
   f. Remove the four capscrews and lockwashers holding the axle extensions through the frame to the transmission case.
   g. Remove the three hex nuts and lockwashers from the stationary disc studs (Figure 17). It may be necessary to remove the oil filter to more easily remove the right rear axle extension. Pull the rear axle extension away from the tractor and slide the coupling from the differential shaft.

2. Disassemble brake assembly.
   a. Remove the brake outer stationary disc from the stationary disc studs (Figure 18).

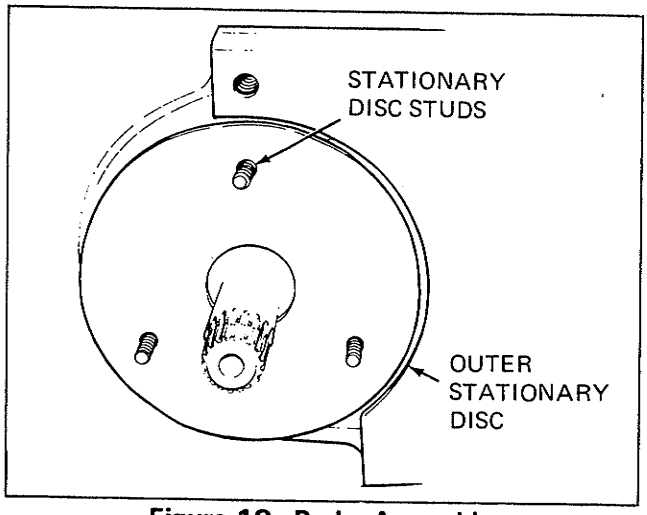


Figure 18. Brake Assembly Outer Stationary Discs and Studs

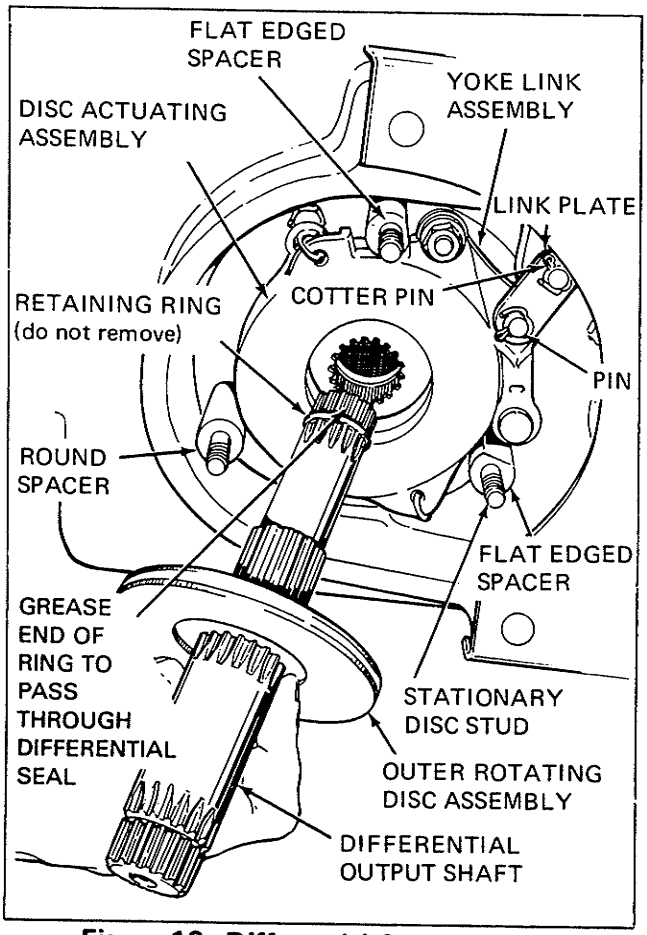


Figure 19. Differential Output Shaft and Outer Rotating Disc

b. Carefully pull the differential output shaft away from the tractor with the outer rotating disc assembly and retaining ring in place (Figure 19). Remove the rotating disc from the shaft.

c. Remove the two flat edged spacers and the one round spacer from the stationary disc studs (Figure 19). Note the location of the flat edge spacers on the disc actuating assembly for reference during assembly.

d. To remove the actuating disc assembly, disconnect the link plates from the yoke link assembly by removing bottom cotter pin and pin (Figure 19). Remove the actuating disc assembly and the inner rotating disc.

Disassembly of Brake Levers and Linkage (Figure 20)

1. Remove the fuel tank. Refer to Fuel Tank and Fuel Gauge Removal, Inspection, and Installation under Fuel System for removal procedures.
2. Remove the cover plate assembly by removing the six 1/4-20 x 3/4 inch long taptite screws.
3. If the brake pedals are locked, retract the brake lockpin. Disconnect the two tension springs (4 and 5) from the front link rods (25 and 26 or 38 and 39) and remove the cotter pins (6) holding the right link rod (26 or 39) to the right anchor (9).
4. Loosen the setscrews (8) holding the right hand brake lever assembly (11). Move the brake anchor to the left to expose the key (10), and remove the key. Remove the brake lever assembly by pulling it through the left hand brake lever assembly (15). Remove the brake anchor assembly (9). Lift the left hand brake lever assembly out of the support assembly.
5. Remove the cotter pins (27) and the pins (28) connecting the link plates (29) with the brake levers (33). Remove the nuts (30) and washers (31) holding the brake levers (33) on the pivot studs (32). The side wall of the frame must be pried outwards to remove the levers from the pivot studs.
6. Disconnect the turnbuckles (23) to remove the link rods. Remove the brake levers (33) from the rear link rods by removing the cotter pins (19) and pins (20).
7. If the bushings (12) in the left hand lever assembly must be removed for replacement, use a suitable tool. Pound out the bushings only if no other tool is available.

Inspection and Repair

Inspect both inner and outer rotating disc assemblies for lining and shaft teeth damage or excessive wear. Inspect brake rods for wear at connection pivot points. Check lever and parking brake cam return springs, and actuating disc springs for wear. Replace any items if there is any doubt of serviceability or performance.

Clean all parts thoroughly with cleaning solvents. Clean the areas in the transmission case where the brake assemblies are to be mounted.

Assembly of Brake Levers and Linkage (Figure 20)

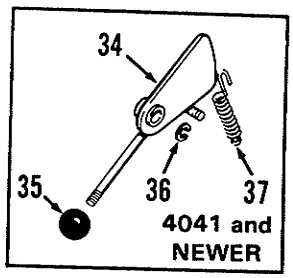
1. If the bushings were removed, use a suitable ram and driver and install new bushings in the left hand lever assembly (15).
2. Install the left hand lever assembly in the support assembly. Insert the right hand lever assembly (11) through the right hand bushing, and the brake anchor assembly (9), and the left hand bushing. Install the key (10) and tighten the left hand lever assembly setscrew (8).
3. Attach the brake levers (33) to the rear link rods (21) using the pins (20) and cotter pins (19). Insert the link rods into the frame and use the nuts (30) and washers (31) to connect the brake levers (33) to the pivot studs. Install the turnbuckles (23) between the front and rear link rods. Use the cotter pin (6) to secure the right front link rod to the right anchor (9).
4. Attach the two springs (4 and 5, or 40 and 41) to the front link rods.
5. Install the fuel tank. Refer to Fuel Tank and Fuel Gauge Removal, Inspection, and Installation under Fuel System for installation procedures.

Installation and Assembly of Brake Assembly

1. Assemble brake assembly.
   a. Check transmission support capscrews for tightness.

LEGEND

1. Spring
2. Pin, roll
3. Rod, lock
4. Spring
5. Spring
6. Pin, cotter
7. Stop
8. Setscrew
9. Anchor assembly
10. Key
11. Lever assembly, right
12. Bearing, sleeve
13. Stop
14. Spring
15. Lever assembly, left
16. Ring, retaining
17. Cam assembly
18. Knob
19. Pin, cotter
20. Pin
21. Rod assembly, rear
22. Nut, jam
23. Turnbuckle
24. Nut, jam
25. Rod, front
26. Rod, front
27. Pin, cotter
28. Pin
29. Plate, link
30. Nut, lock
31. Washer, flat
32. Stud
33. Lever, brake
34. Cam assembly
35. Knob
36. Ring, retaining
37. Spring
38. Rod, front
39. Rod, front
40. Spring
41. Spring



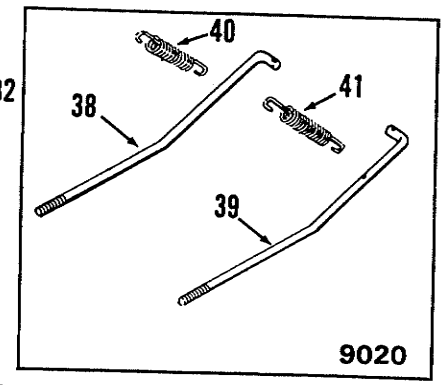


Figure 20. Brake Levers and Linkage

b. Install the outer rotating disc, the disc actuating assembly and the inner rotating disc onto the differential output shaft.

c. To avoid damaging the brake seal, carefully insert the differential output shaft through the seal support assembly until the retaining ring on the shaft seats against the differential gear. Be sure that the splined shaft end is free of burrs and is lubricated with a small amount of type A, F or dexron automatic transmission fluid oil before inserting the shaft through the brake seal.

d. Secure the disc actuating assembly and the brake lever to the link plates with the pins and cotter pins (Figure 19).

e. Install the two flat edged spacers and one round spacer on the stationary disc studs (Figure 19), making sure that the flat edges of the spacers are facing the torque lugs on the actuator when the spacers are centered on their tracks.

f. Install the outer stationary disc on the stationary disc studs (Figure 18).

2. Install the brake assembly.

a. Install the coupling on the differential shaft.

The flat end of the coupling must be assembled toward the transmission and the counterbored end toward the drop housing. The spring fits into the counterbore in the coupling (Figure 14).

b. Align the rear axle extension with the stationary disc studs and secure the extension to the brake assembly with the three hex nuts and lockwashers (Figure 17). Install the oil filter if it was removed during the removal of the right rear axle.

c. Secure the axle extension to the differential case through the frame with the four capscrews and lockwashers.

d. Position the draw bar inside the frame and secure it through the lower holes with the two 1/2-13 x 1-1/2 long capscrews, lockwashers and nuts (Figure 17).

e. Align the mid-point hitch support assemblies and the draw bar with the rear axle extensions and secure with the two 1/2-13 x 1-1/2 and long capscrews and nuts (Figure 17).
Reinstall the wire guides on the axle extensions.

f. Connect the lift cylinder to the left rear axle extension and lift arm assembly with the hairpin clips and pins. Make sure to install the pins so the hairpin clips are on the left side.

g. Install the lift cables in the wire guides.

h. Install the drop housing and wheel. Refer to Wheels and Drop Housing for installation procedures.

i. Adjust brake linkage. Refer to Brake Adjustment under General Information.

j. Install the cover plate assembly using the six 1/4-20 x 3/4 inch long taptite screws.

POWER TRAIN SYSTEM

Description (Figure 21)

The power train system consists of a foot pedal operated clutch, the main drive assembly, the hydrostatic transmission, the three range transmission and the differential assembly. The clutch is a double V-belt drive clutch which performs clutching action by varying the distance between the upper pulley and the lower clutch pulley. Power is then transmitted through the disc type self-aligning couplings which combine with the yokes to form universal joints. These universal joints and the shaft assembly form the main drive.

The hydrostatic transmission is a variable delivery piston type pump with a fixed stroke piston type motor and a replaceable oil filter.

The transmission case houses a three-speed sliding spur gear transmission on roller contact bearings; an eight pinion, spur gear, non-adjustable limited slip differential; and a final drive made up of individual spur gears on roller bearings.

Operation

1. Clutch.

The clutch pedal is used to disconnect the transmission from the engine. Because the tractor is equipped with a hydrostatic transmission, the clutch is not required for starting, stopping, or shifting gears. When the clutch is engaged (pedal out), power is transmitted from the engine through the input pulley, universal joints and the main drive to the hydrostatic motor and pump in the hydrostatic transmission. The clutch should only be used for emergency stops and cold weather starting.

2. Hydrostatic Transmission.

Refer to the In-line Hydrostatic Unit section at the end of Volume 2 of this manual.

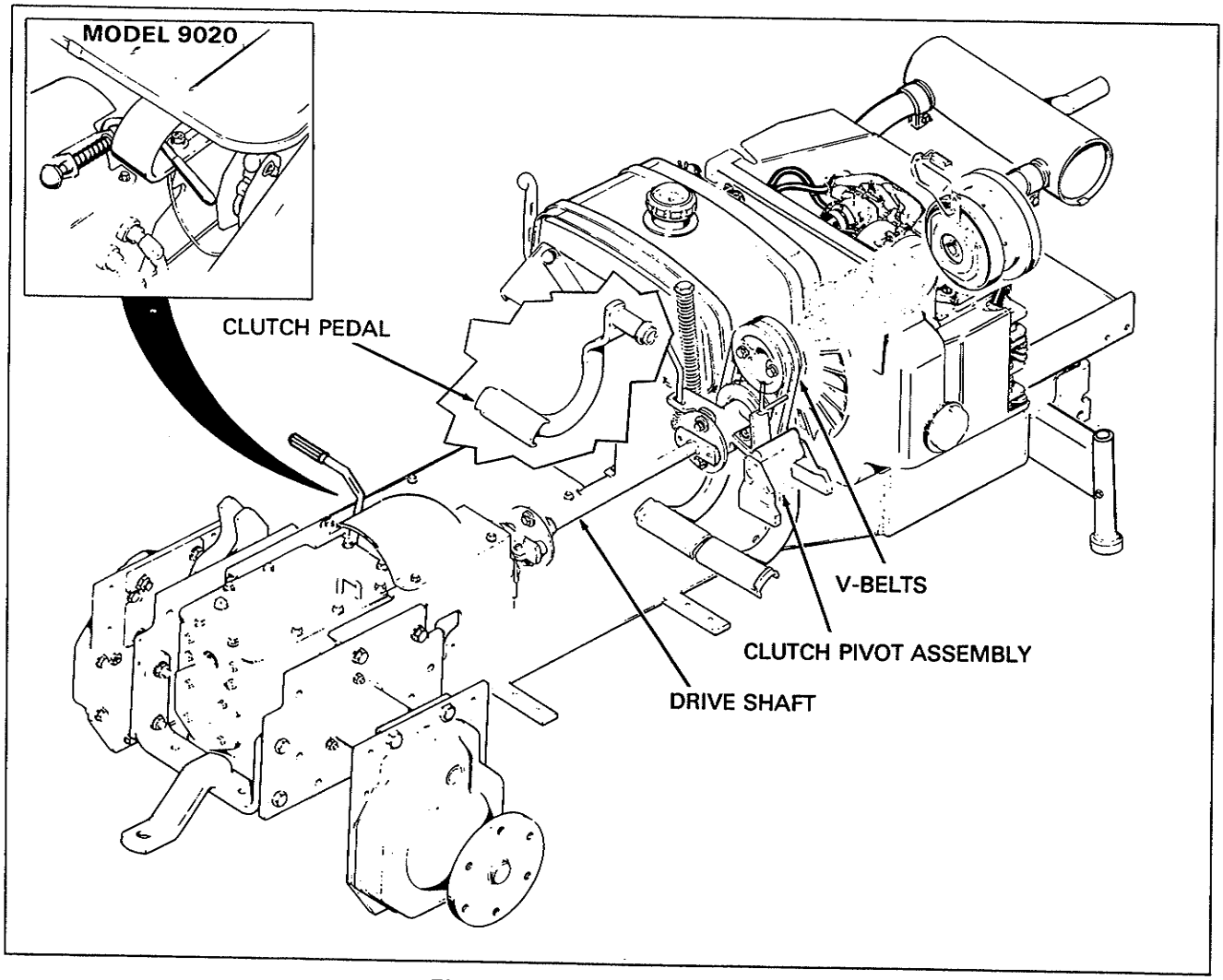


Figure 21. Power Train System

3. Transmission.

Forward and reverse tractor direction are controlled by the hydrostatic control lever mounted on the right side of the control panel. Speed range is controlled by the three-speed transmission lever located on the left side of the transmission under the operator's seat (Figure 22).

The three-speed gear transmission consists of an input and sliding gear shaft. The input shaft rotates three stationary gears that are fixed in position by spacers, and the sliding gear shaft rotates two sliding gears which have an integral gear as part of the shaft.

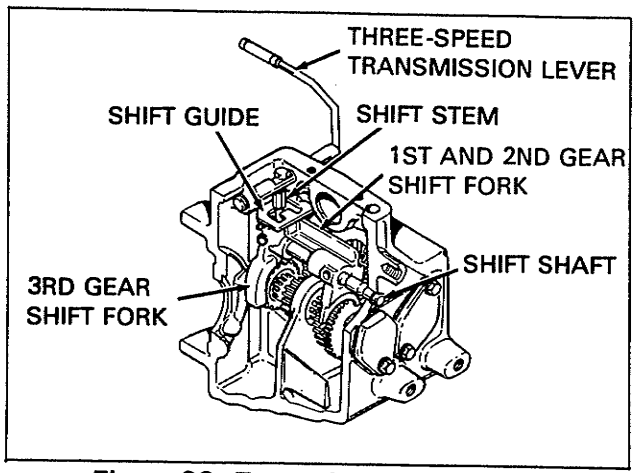


Figure 22. Transmission Shift Forks

The three-speed transmission lever moves the shift stem in the shift guide to activate the desired gear assembly. When the shift stem is positioned in the 1st and 2nd gear guide track, it moves the 1st and 2nd gear fork along the shift shaft to align either the 1st or 2nd gear of the sliding gear assembly with its mating stationary gear on the input shaft. The shift stem, when it is positioned in the 3rd gear track, moves the 3rd gear fork along the shift shaft to align the sliding 3rd gear with its mating stationary 3rd gear assembly.

Figure 23 illustrates gear position when the shift stem is in the neutral track of the shift guide. In this position, each stationary gear rotates freely. The sliding gear shaft rotation is transmitted to the differential gear assembly through the shaft's integral gear.

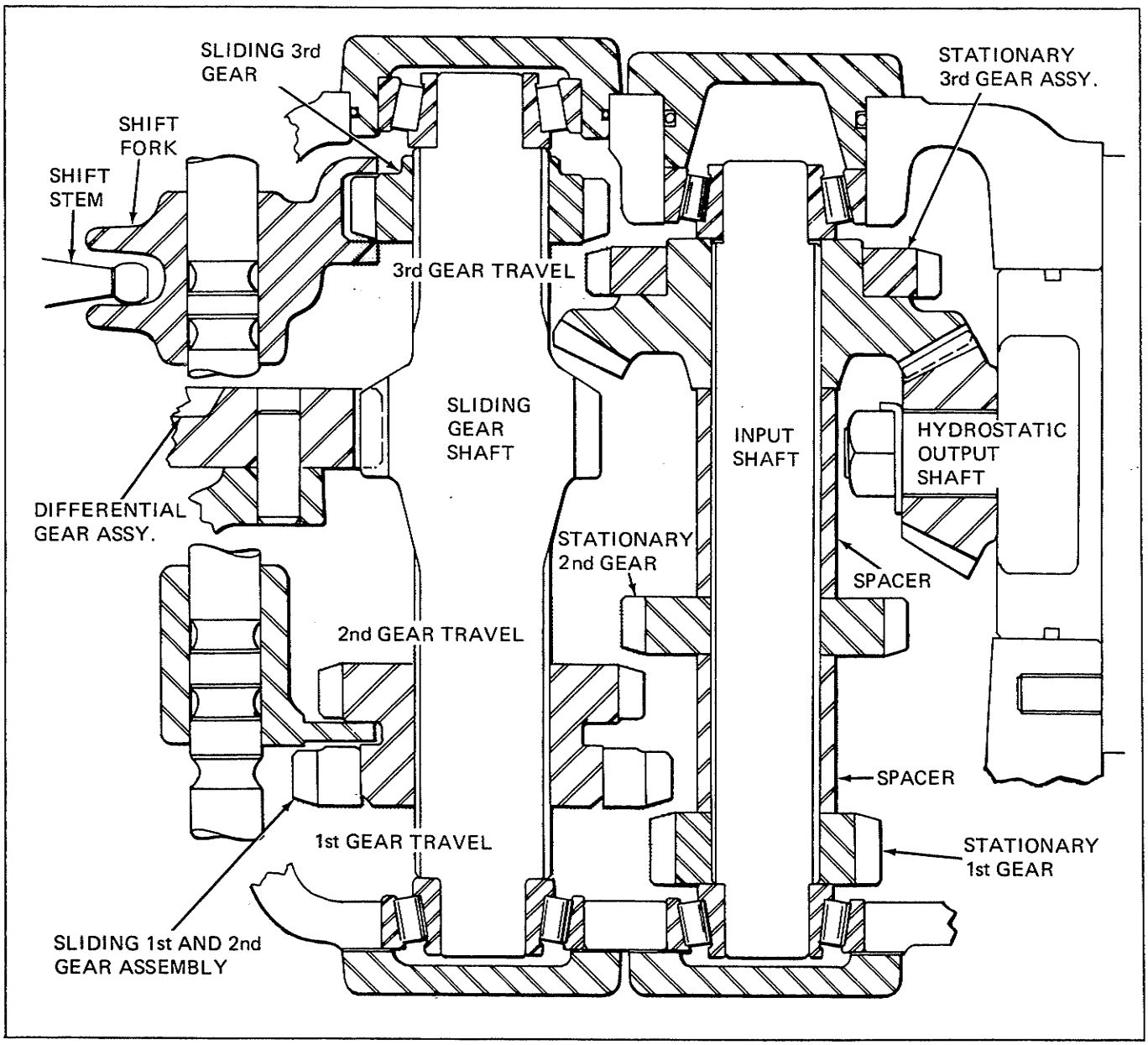


Figure 23. Three-speed Gear Operation (Neutral Position)

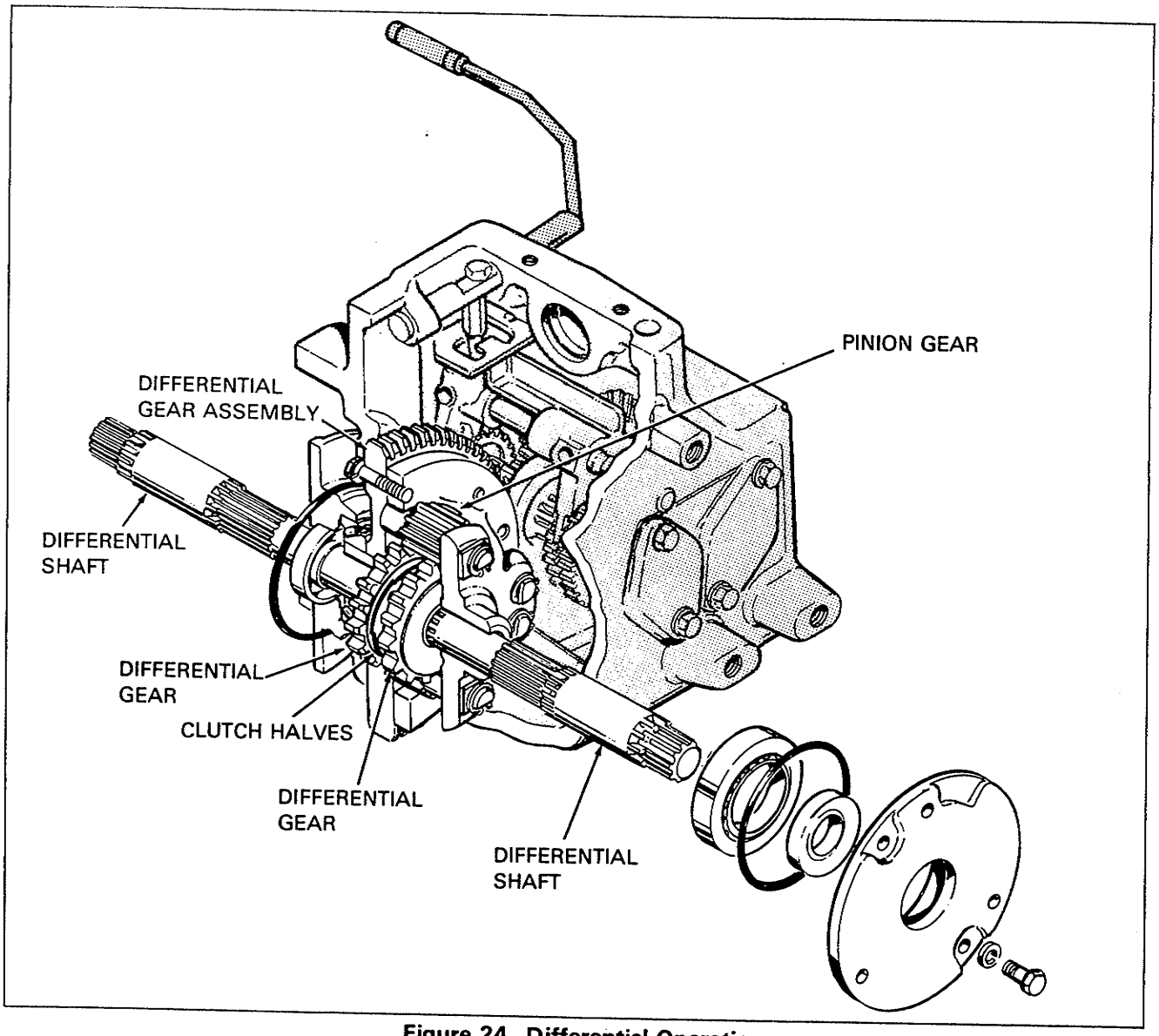


Figure 24. Differential Operation

4. Differential (Figure 24).

The differential gear assembly rotates four pairs of pinion gears. Each gear of each pair turns a separate differential gear and shaft. Both differential shafts are coupled by a slip clutch. The halves of the slip clutch are separated by four spring washers which provide a slight outward pressure on the clutch halves so if the movement of one rear wheel slows or stops, the clutch halves will slip and movement of the other wheel will continue.

5. Rear PTO (Figure 25).

The rear PTO shaft rotates with the engine flywheel to power the final drive system. The final drive shaft drives the intermediate gear which, in turn, rotates the final gear.

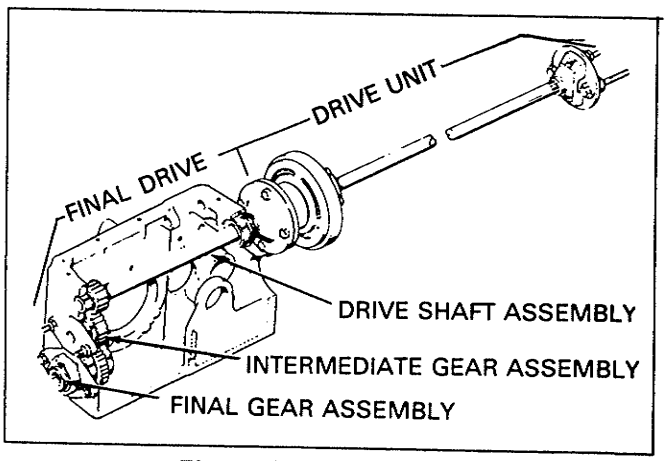


Figure 25. Rear PTO

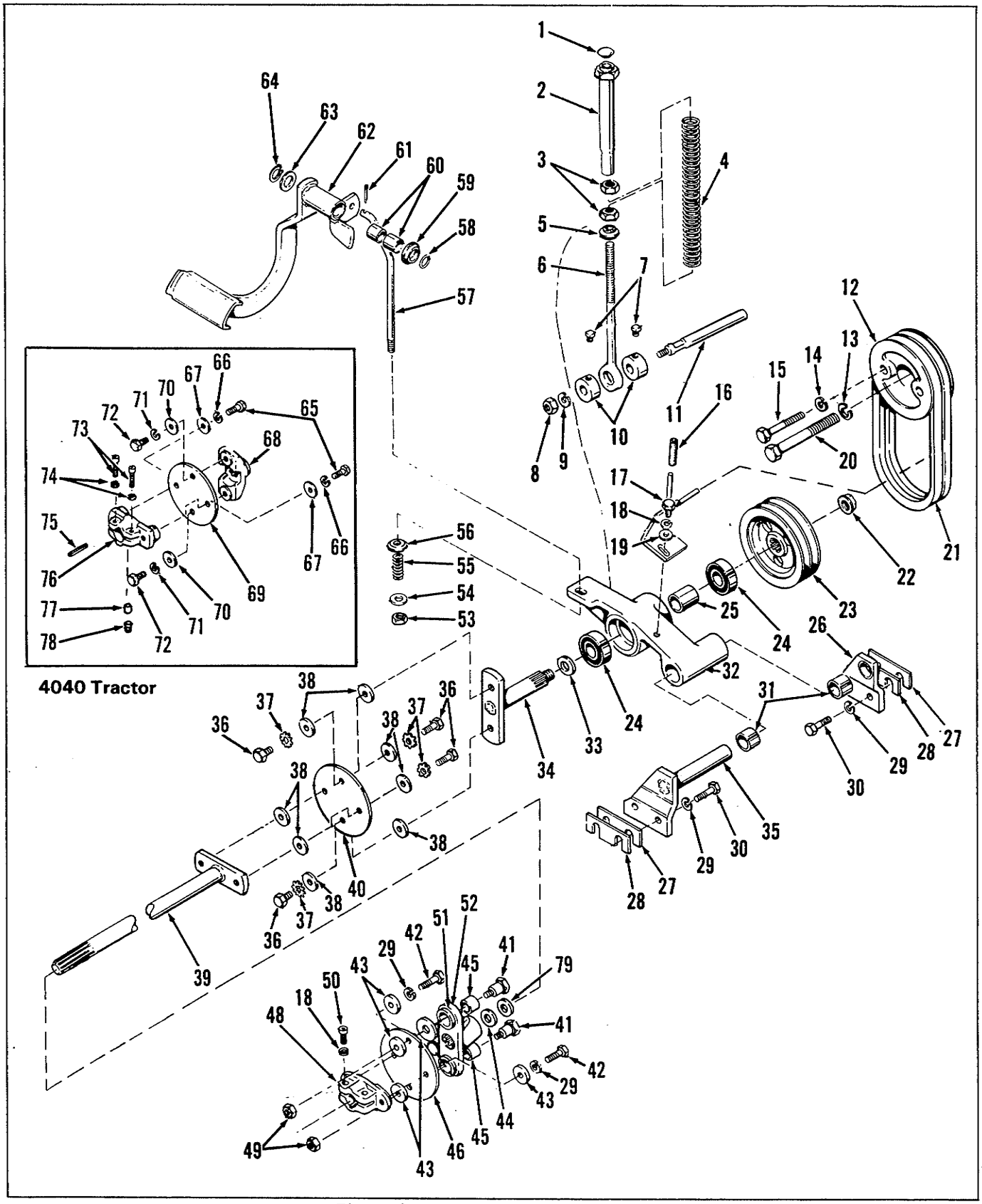


Figure 26. Clutch and Drive Shaft

LEGEND

1. Plug
2. Tube assembly
3. Nut, jam
4. Spring. clutch
5. Spacer, clutch
6. Bolt, eye
7. Setscrew
8. Nut
9. Washer, lock
10. Collar
11. Shaft, pivot
12. Pulley, input
13. Washer, lock
14. Washer, lock
15. Capscrew, hex (3/8-16 x 2-1/2)
16. Hose
17. Capscrew
18. Washer, lock
19. Washer, flat
20. Capscrew, hex (7/16-14 x 4-1/2)
21. Belts, matched "V"
22. Nut, flange
23. Pulley, clutch
24. Bearing
25. Spacer
26. Support assembly
27. Shim
28. Shim
29. Washer, lock
30. Capscrew, hex (3/8-16 x 1-1/4)
31. Bushing
32. Arm, pivot
33. Washer
34. Shaft, pivot arm
35. Support assembly
36. Capscrew, hex (3/8-16 x 3/4)
37. Washer, lock
38. Washer, flat
39. Shaft, drive
40. Coupling
41. Bolt, shoulder
42. Capscrew, hex (3/8-16 x 1)
43. Washer, flat
44. Washer, felt
45. Bushing
46. Plug
47. Coupling
48. Clamp, yoke
49. Nut
50. Screw, socket
51. Yoke
52. Fitting, lube
53. Nut
54. Washer, flat
55. Spring, clutch rod
56. Spacer, clutch
57. Rod, clutch
58. Ring, retaining
59. Washer
60. Bearing, sleeve
61. Pin, cotter
62. Lever assembly
63. Washer
64. Ring, retaining
65. Capscrew
66. Washer, lock
67. Washer, flat
68. Yoke, clamp
69. Coupling
70. Washer, flat
71. Washer, lock
72. Capscrew
73. Screw, socket
74. Washer, lock
75. Key
76. Yoke, clamp
77. Plug
78. Setscrew
79. Washer, rubber

CLUTCH

Clutch Disassembly (Figure 26).

1. Remove cover plate assembly, bottom frame cover, oil cooler, and left and upper engine shrouds.
2. Remove the tube assembly (2) and spring (4) from the clutch belt tension assembly. Loosen the setscrews (7) holding the collars (10) in position on the tension assembly's pivot shaft (11). Disconnect the eye bolt (6) from the pivot shaft by removing the nut (8) and lockwasher (9).
3. Disconnect the main drive shaft coupling (40) from the pivot arm shaft (34) by removing the two 3/8-16 x 3/4 inch long capscrews (36) and washers (37 and 38).
4. Disconnect the support assemblies (26 and 35) by removing the two 3/8-16 x 1-1/4 inch long capscrews (30) and lockwashers (29). Note the position of the shims (27 and 28), and remove the front support assembly (26) and shims.
5. Work the two V-belts (21) forward off the clutch pulley (23).
6. Disconnect the clutch rod (57) from the clutch lever assembly (62) by removing the cotter pin (61), and remove the clutch pivot assembly from the frame.

NOTE

Remove the input pulley for replacement only.

7. If the rear PTO was disconnected previously, remove the input pulley (12) by removing the 7/16-14 x 4-1/2 inch long capscrew (20) and lockwasher (13). If there is no rear PTO, remove the engine pulley by removing the two 3/8-16 x 2-1/2 inch long capscrews (15) and lockwashers (14) in addition to the 7/16-14 x 4-1/2 inch long capscrew and lockwasher.
8. Remove the clutch pulley (23) by removing the flange nut (22) and by carefully pulling it off the pivot arm shaft (34). Remove the pivot arm shaft, the pivot arm (32), and the rear support assembly (35).
9. Check the pivot arm bearings (24) and bushings (31) for wear or damage. If the bearings or bushings must be replaced, remove them with a suitable tool.

Clutch Inspection, Cleaning and Repair (Figure 26)

Inspect the components of the clutch and pivot assemblies for signs of wear. Replace any parts which are excessively worn. Check the condition of both belts, and if the rubber is hard, cracked or frayed, replace the belts.

Check the clutch belt tension spring (4) for weakness or deformation. Check that the spring has a free length of 9.750 inches. Replace the spring if it is damaged or does not meet specifications.

Check the clutch rod spring (55) for weakness or deformation. This spring has a free length of 1.375 inches. Replace the spring if it is damaged or does not meet specifications.

Inspect and clean the pivot arm bearings.

Clean all parts thoroughly with approved solvents. Clean the area in the frame where the clutch is to be mounted.

Clutch Assembly (Figure 26)

1. If the pivot arm bushings (31) were removed, install them. Install bearings (24) in the pivot arm making certain the spacer (25) is in place.
2. Insert the pivot arm shaft (34) through the pivot arm bearings and carefully install the clutch pulley (23) on the shaft. Attach the clutch pulley to the pivot arm shaft with the flange nut (22). Torque the nut to 75 foot-pounds.
3. Assemble the clutch rod (57), clutch rod spring (55), spacer (56), washer (54), and locknut (53) on the pivot arm.
4. If the input pulley (12) was removed, install it on the flywheel using the 7/16-16 x 4-1/2 inch long capscrew (20) and lockwasher (13) and the two 3/8-16 x 2-1/2 inch long capscrews (15) and lockwashers (14). Replace the two V-belts on the input and clutch pulleys.
5. Install the pivot arm and support assemblies (26 and 35) on the tractor using the shims (27 and 28) and the two 3/8-16 x 1-1/4 inch long capscrews (30) and washers (29).
6. Install the eyebolt (6) and collars (10) on the pivot shaft (11) with the nut (8) and lockwasher (9). Position the collars and tighten the setscrews (7). Loosely install the spring (4) and tube assembly (2) on the eyebolt.
7. Connect the clutch rod (57) to the clutch lever assembly (62) with the cotter pin (61).
8. Connect the main drive shaft coupling (40) to the pivot shaft (34) using the two 3/8-16 x 3/4 inch long capscrews (36) and washers (37 and 38).
9. Adjust clutch free travel and clutch belt tension. Refer to Clutch Pedal Free Travel Adjustment and Clutch Belt Tension under General Information.
10. Install the left and upper engine shrouds, oil cooler, bottom frame, and cover plate assembly.

DRIVE SHAFT

Drive Shaft Removal (Figure 26)

1. Remove the bottom cover.
2. Disconnect the main drive shaft coupling (40) from the pivot shaft (34) by removing the two 3/8-16 x 3/4 inch long capscrews (36) and washers (37 and 38).
3. Remove the coupling from the drive shaft (39) by removing the two 3/8-16 x 3/4 inch long capscresw (36) and washers (37 and 38). Remove the coupling from the tractor.
4. Remove the rear coupling (47 or 69) by removing the two 3/8-16 x 1 inch long capscrews (42 or 65) and washers (29 and 43 or 66 and 67) and the two shoulder bolts (41 or 72), washers (43 or 71 and 70), and nuts (49).
5. Carefully move the drive shaft (39) and yoke (51 or 68) forward and then back up out of the tractor frame. Remove the yoke from the drive shaft.
6. If the yoke bushings (45) must be removed for replacement, remove them with a suitable tool.
7. Remove the two socket head capscrews (50 or 73) and lockwashers (18 or 74) from the yoke clamp (48 or 63) and remove the yoke clamp and key (75)

Drive Shaft Installation (Figure 26)

1. If the yoke clamp bushings were removed, install them.
2. Install the yoke clamp (48 or 63) using the two socket head capscrews (50 or 73) and lockwashers (18 or 74). Make sure the key (75) is in place.

3. Install the yoke (51 or 68) on the drive shaft (39), and insert the drive shaft into the tractor body. Align the rear coupling (47 or 69) with the yoke and yoke clamp and secure it with the two 3/8-16 x 1 inch long capscrews (42 or 65) and washers (29 and 43 or 66 and 67) and nuts (49).
4. Install the coupling (40) on the front end of the drive shaft using the two 3/8-16 x 3/4 inch long capscrews (36) and washers (37 and 38).
5. Attach the coupling to the pivot arm shaft (34) with the two 3/8-16 x 3/4 inch long capscrews (36) and washers (37 and 38).
6. Check the clutch free travel and clutch belt tension and adjust if necessary. Refer to Clutch Pedal Free Travel Adjust and Clutch Belt Tension under General Information.
7. Install the bottom cover.

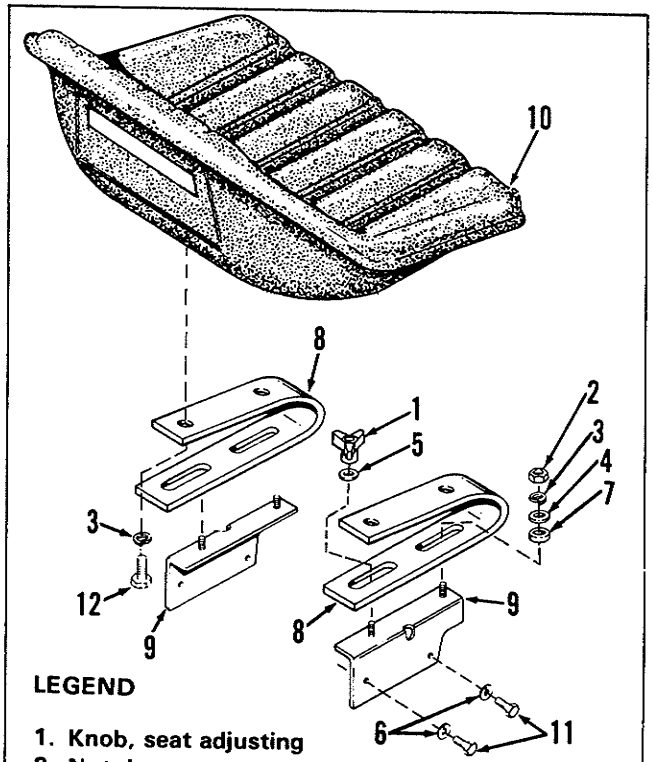
TRANSMISSION

Transmission Removal and Disassembly

1. Remove transmission case.
   a. Remove the seat and seat adjuster assembly on 4040, 4041, Pow'r Max tractors, and on 9020 tractors with Manufacturer No. 1690072 by removing the four 3/8-16 x 1 inch long capscrews and lockwashers holding the seat adjuster assembly to the differential cover.

      To remove the seat, seat supports, and seat springs (Figure 27) on 9020 tractors with Manufacturing No. 1690230 or 1690283, first remove the two seat adjusting knobs (1), hex nuts (2), washers (3, 4, and 5), and spacers (7) holding the seat springs (8) to the seat supports (9). Lift the seat (10) and seat springs off of the seat support studs. Then remove the seat supports by removing the four 1/2-13 x 1-1/2 inch long capscrews (11) and lockwashers (6) holding them to the tractor frame.

   b. Remove cover assembly and bottom cover.
   c. If the rear PTO shaft assembly is connected to the PTO shaft, disconnect the electric clutch from the PTO shaft hub by removing the four 5/16-18 x 1 inch long taptite screws.
   d. Remove the rear coupling (47 or 69, Figure 26) by removing the two 3/8-16 x 1 inch long capscrews (42 or 65) and washers (29 and 43 or 66 and 67) and the two shoulder bolts (41 or 72), washers (43 or 71 and 70), and nuts (49).
   e. Disconnect the hydrostatic pump inlet hose from the oil filter and the electrical connection from the transmission temperature sending unit. Disconnect the hydrostatic control arm, the hydrostatic unit-to-valve tube assembly, and the hydrostatic unit-to filter hose.
   f. Block the front wheels, and using an appropriate jack, raise the rear end of the tractor to the required height for wheel removal. Support the frame in front of the transmission case on a suitable stand. Then, remove the rear wheels, drop housing, and brake assemblies. Refer to Wheels and Drop Housings, and Brakes for removal procedures.



LEGEND

1. Knob, seat adjusting
2. Nut, hex
3. Washer
4. Washer
5. Washer
6. Washer, lock
7. Spacer
8. Seat, spring
9. Seat, Support
10. Seat
11. Capscrew
12. Capscrew

Figure 27. Seat assembly

g. Place a suitable container under the transmission case, and remove the dipstick assembly, elbow, and temperature sending unit allowing the transmission oil to drain from the case.

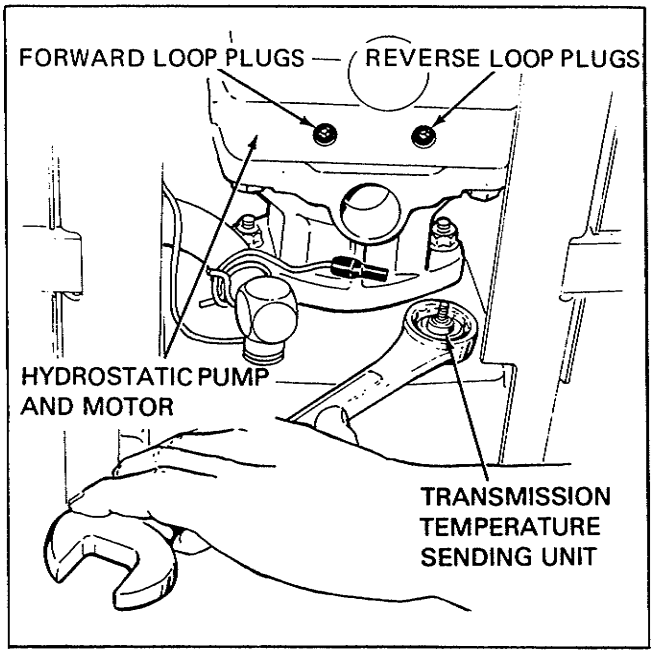


Figure 28. Hydrostatic Pump Inlet and Transmission Temperature Sending Unit

h. Remove the cotter pins (19, Figure 20) and pins (20) securing the rear brake rods (21) to the brake levers (33).

i. Remove the two remaining capscrews and lockwashers mounting the transmission case to the frame. Use a hoist to remove the transmission case and hydrostatic unit from the tractor frame.

j. Remove the two flange nuts securing the hydrostatic unit to the transmission case.

2. Disassemble the transmission.

a. Remove the remaining capscrews and lockwashers holding the transmission case cover to the transmission case (Figure 29). Lift the cover from the case and remove the gasket.

b. Remove the PTO final drive shaft. Refer to PTO Final Drive for removal procedures.

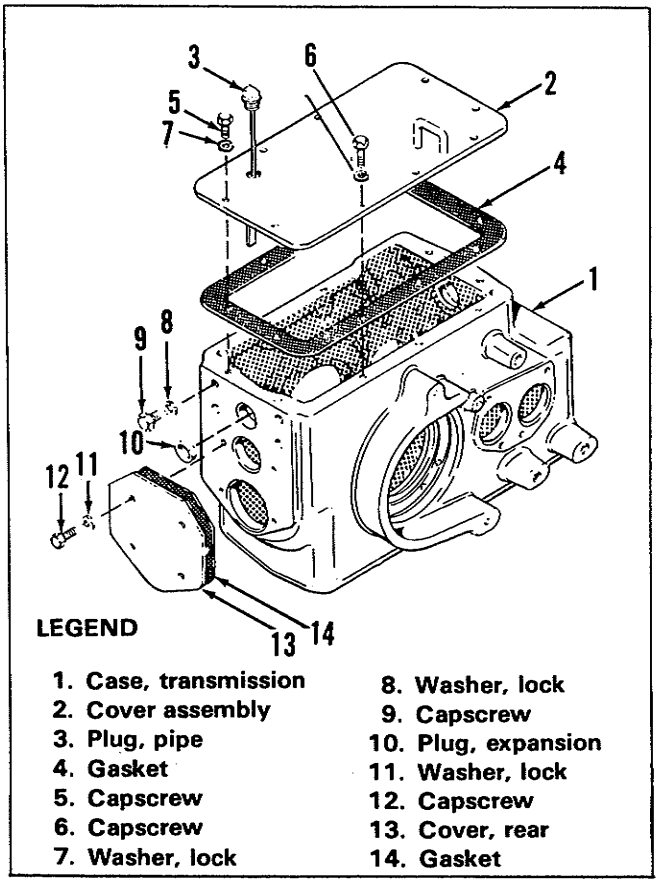
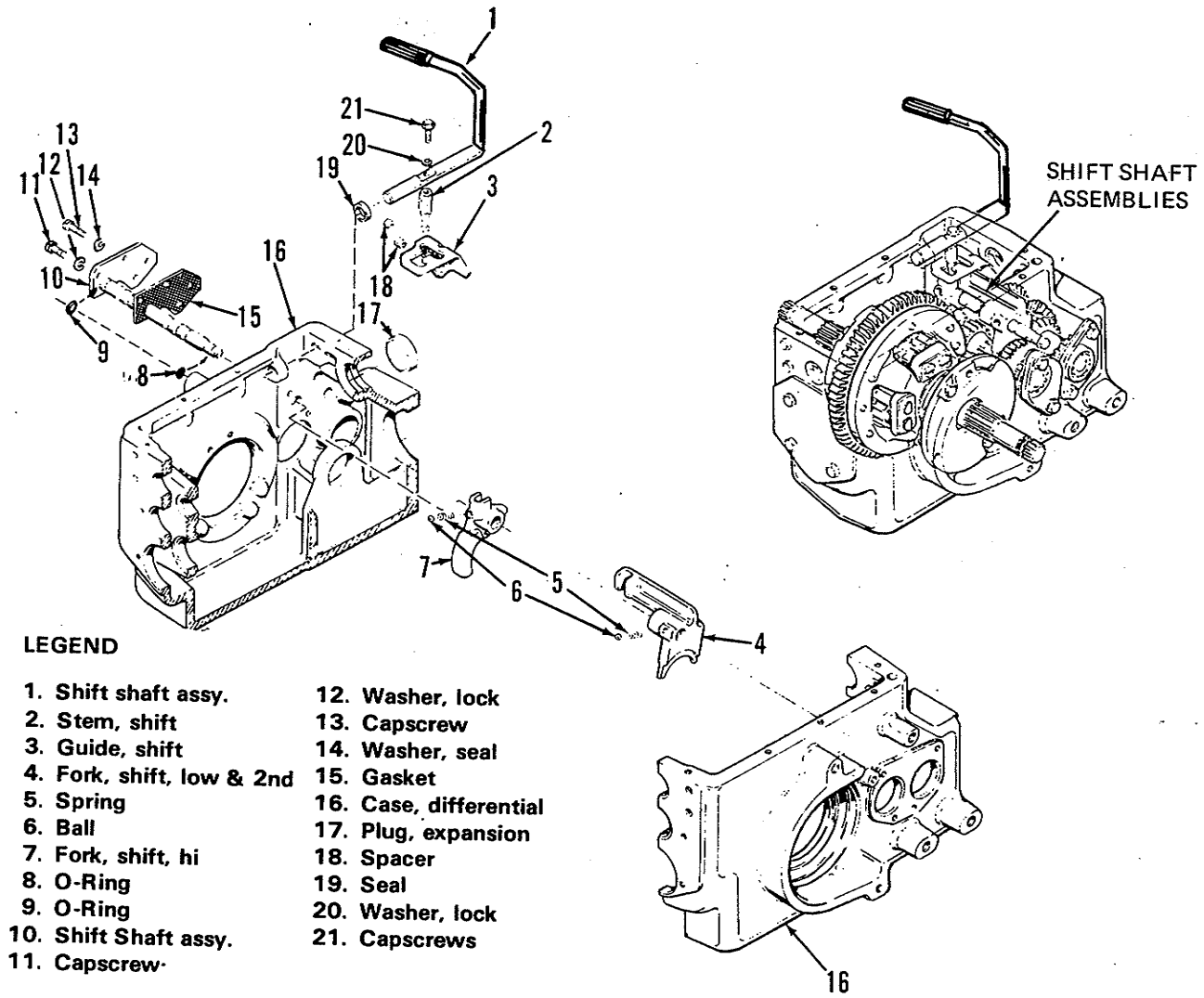


Figure 29. Transmission Case Covers

c. Remove the 5/16-18 x 1 inch long capscrew (21, Figure 30) and lockwasher (20) attaching the shift shaft assembly (1) to the shift stem (2). Remove the stem and shaft from the transmission case. Remove and discard the seal (19).

d. Remove the shift guide (3, Figure 30) and its two spacers (18) by removing the two 1/4-20 x 1 inch long capscrews (13) and lockwashers (14) mounting it to the transmission case.

e. Remove the two 3/8-16 x 3/4 inch long capscrews (11, Figure 30) and lockwashers (12) holding the shift shaft assembly (10) to the transmission case. Carefully pull the shaft from the left side of the transmission case and remove the two shift forks (7 and 9). Make sure to obtain the springs (5) and balls (6) as they fall from the forks. Remove and discard the o-rings and gaskets.



LEGEND

1. Shift shaft assy.
2. Stem, shift
3. Guide, shift
4. Fork, shift, low & 2nd
5. Spring
6. Ball
7. Fork, shift, hi
8. O-Ring
9. O-Ring
10. Shift Shaft assy.
11. Capscrew
12. Washer, lock
13. Capscrew
14. Washer, seal
15. Gasket
16. Case, differential
17. Plug, expansion
18. Spacer
19. Seal
20. Washer, lock
21. Capscrews

NOTE

USE CAPSCREW TO HOLD BALL AND SPRING IN POSITION WHILE INSTALLING SHIFT FORKS ON SHAFT (SEE STEP 13, 1-31).

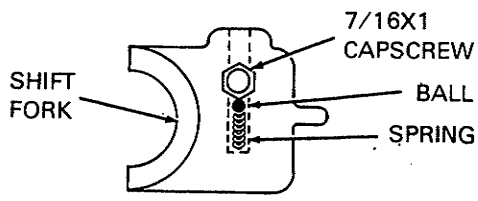
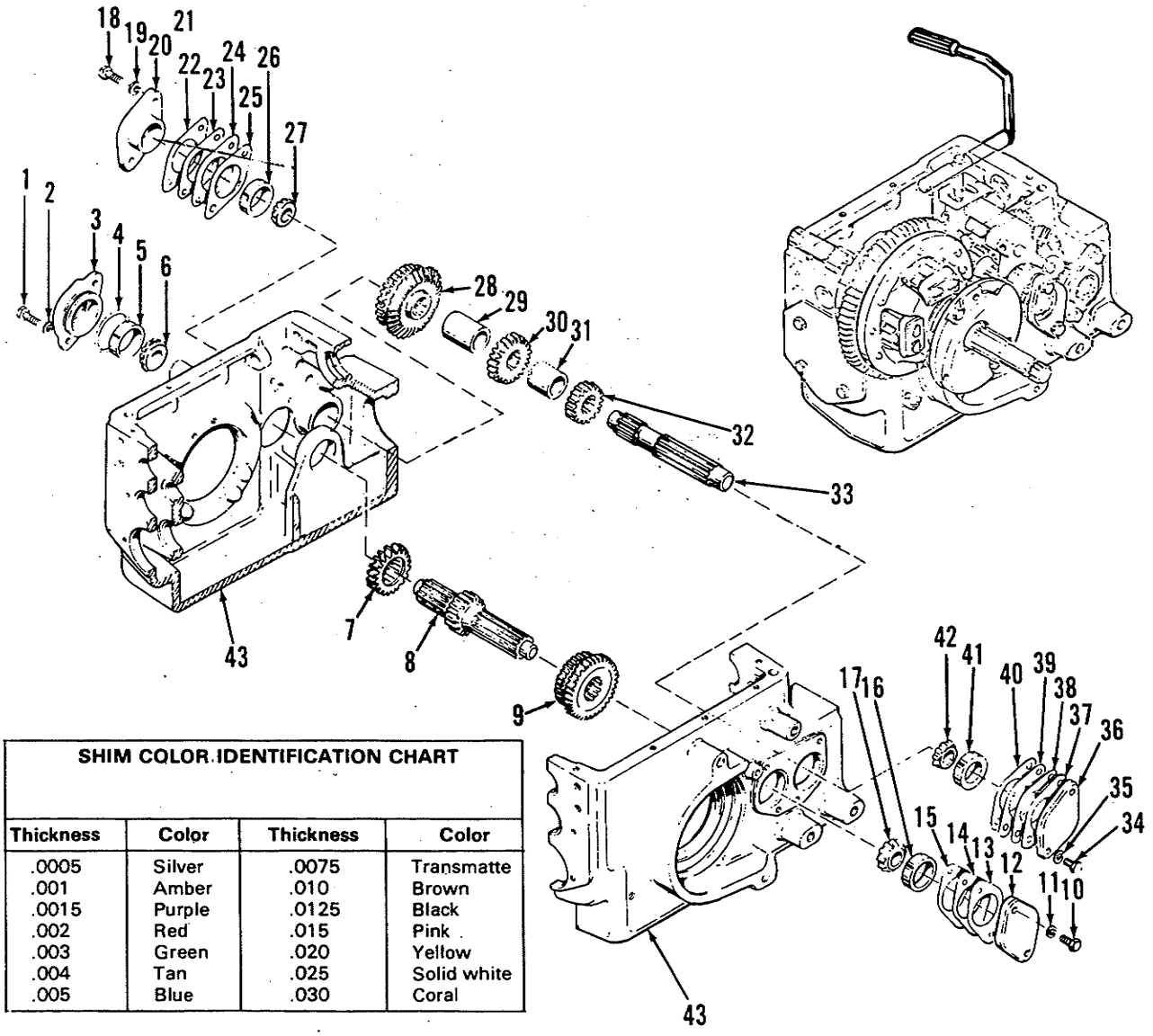


Figure 30. Shift Shaft Assemblies



SHIM COLOR IDENTIFICATION CHART

Thickness	Color	Thickness	Color
.0005	Silver	.0075	Transmatte
.001	Amber	.010	Brown
.0015	Purple	.0125	Black
.002	Red	.015	Pink
.003	Green	.020	Yellow
.004	Tan	.025	Solid white
.005	Blue	.030	Coral

LEGEND

1. Capscrew
2. Washer, lock
3. Cap, retaining
4. O-Ring
5. Cup, bearing
6. Cone, bearing
7. Gear, 20T
8. Shaft, sliding gear
9. Gear assy., low & 2nd
10. Capscrew
11. Washer, lock
12. Cap
13. Shim, 0.005
14. Shim, 0.003
15. Shim, 0.002
16. Cup, bearing
17. Cone, bearing
18. Capscrew
19. Washer, lock
20. Cap
21. O-Ring
22. Shim, 0.010
23. Shim, 0.005
24. Shim, 0.003
25. Shim, 0.002
26. Cup, bearing
27. Cone, bearing
28. Bevel gear assy.
29. Spacer
30. Gear, 23T
31. Spacer
32. Gear, 18T
33. Shaft, input
34. Capscrew
35. Washer, lock
36. Cap
37. Shim, 0.010
38. Shim, 0.005
39. Shim, 0.003
40. Shim, 0.002
41. Cup, bearing
42. Cone, bearing
43. Case, differential

Figure 31. Transmission

NOTE

Before removing items such as caps, mark each cap properly using a punch mark on similar method to assure proper assembly.

f. Remove the retainer cap (3, Figure 31) and its o-rings (4) by removing the two 3/8-16 x 7/8 inch long capscrews (1) and lockwashers (2) holding it to the transmission case. If the bearing cup (5) must be replaced, remove it using a bearing cup puller. Be sure the tongs of the puller are aligned with the grooves in the cup. Carefully remove the bearing cone (6) by sliding it off the gear shaft (8).

NOTE

Keep the bearing cups and cones together as sets, and note their locations in the transmission case to assist during assembly.

g. Remove the cap (12, Figure 31) and shims (15, 14, 13) by removing the two 3/8-16 x 7/8 inch long capscrews (10) and lockwashers (11). Remove the bearing cup (16) from the transmission case.

h. Slide the gear (7, Figure 31) off the gear shaft and through the retainer cap hole. Move the gear shaft (8) partially through the retainer cap hole, and remove the bearing cone (17) and gear assembly (9) from the shaft. Then, remove the gear shaft from the transmission case.

NOTE

Keep the shims together, and note their locations in the transmission case. Reshimming may not be necessary if bearings are not replaced.

i. Remove the cap (20, Figure 31) and shims (22, 23, 24, 25) by removing the two 3/8-16 x 7/8 inch long capscrews (18) and lockwashers (19). Remove the o-ring (21) from the cap and discard.

j. Remove the cap (36, Figure 31) and shims (37, 38, 39, 40) by removing the two 3/8-16 x 7/8 inch long capscrews (18) and lockwashers (19). Remove the bearing cup (41) from the transmission case.

k. Slide the bearing cone (42, Figure 31), gear (32), and spacer (29) off the input shaft (33) through the right cap (36) hole.

l. Move the input shaft (33, Figure 31) with the gear (28), and bearing cup (26) and cone (27) to the right, and then remove them carefully through the top of the transmission case along with spacers 29 and 31 and gear 30. Remove the bearing cup and cone from the shaft.

Inspection, Cleaning, and Repair of Transmission

1. Wash all parts with cleaning solvent and dry thoroughly with compressed air. Do not spin bearings with compressed air. Check the bearings for looseness, wear, roughness, pitting or scoring. Replace them if necessary. Refer to Bearing Cleaning and Inspection under General Information.
2. Check all gears and shafts for wear and burrs. Replace all damaged parts.
3. Inspect the transmission case for cracks or raised places on machined surfaces.
4. Replace all gaskets, oil seals, and o-rings.
5. Lubricate all parts thoroughly before installation.

Transmission Assembly

NOTE

Shims (22, 23, 24, 25, Figure 31) determine the location of the bevel gear assembly on the input shaft. This location is critical to obtain the proper meshing of the bevel gear with the hydrostatic unit bevel pinion. Refer to shim color chart on Figure 31.

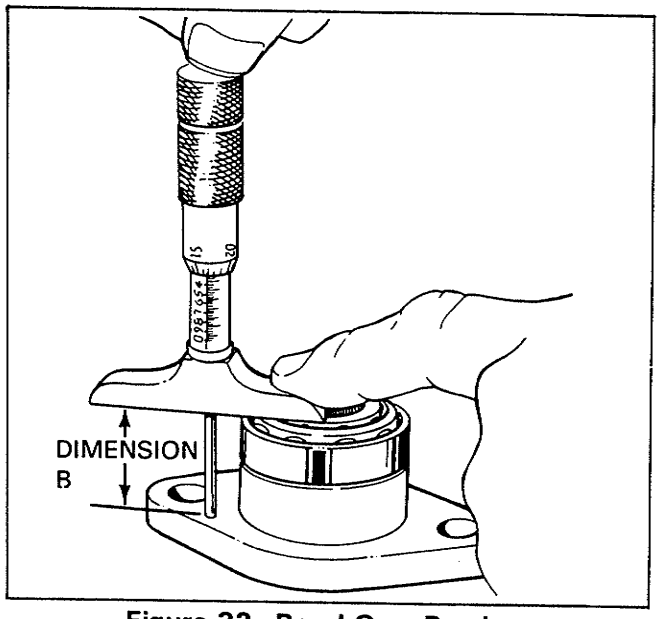


Figure 32. Bevel Gear Bearing and Cap Measurement

DIAL INDICATOR READ OUT

DIMENSION "A"

DIMENSION "B"	3.118	3.119	3.120	3.121	3.122	3.123	3.124	3.125	3.126	3.127	3.128
1.255	.012	.011	.010	.009	.008	.007	.006	.005	.004	.003	.002
1.257	.014	.013	.012	.011	.010	.009	.008	.007	.006	.005	.004
1.259	.016	.015	.014	.013	.012	.011	.010	.009	.008	.007	.006
1.261	.018	.017	.016	.015	.014	.013	.012	.011	.010	.009	.008
1.263	.020	.019	.018	.017	.016	.015	.014	.013	.012	.011	.010
1.265	.022	.021	.020	.019	.018	.017	.016	.015	.014	.013	.012
1.267	.024	.023	.022	.021	.020	.019	.018	.017	.016	.015	.014
1.269	.026	.025	.024	.023	.022	.021	.020	.019	.018	.017	.016
1.271	.028	.027	.026	.025	.024	.023	.022	.021	.020	.019	.018
1.272	.030	.029	.028	.027	.026	.025	.024	.023	.022	.021	.020

1. If a new bearing cone (27, Figure 31), cup (26), and/or cap (20) are to be installed, clean the cone, cup, and cap, and assemble the components as shown. Rotate the cone in the cup to be sure it is seated. Using a depth micrometer, measure the distance from the cap surface the upper surface of the bearing cone (Dimension B, Figure 32).

   The required case dimension (Dimension A, Figure 32) is stamped on the transmission case during manufacturing. To determine the shimming required, refer to the shim chart.

Example: Cap and bearing measurement = 1.267 inches
(Dimension B)

Dimension stamped on case = 3.119 inches
(Dimension A)

Shimming required = 0.023 inches

Install the gear (28, Figure 31) on the input shaft (33).

2. Slide bearing cone (27) on the left end of the input shaft. Slide spacer (29), gear (30) and spacer (31) on the right end of the input shaft in that order. Insert the input shaft with the gears, spacers and bearing cone into the transmission case. Slide gear (32) on the right end of the input shaft.
3. Coat the surface of the correct number of shims (determined above) with a sealer such as Permatex. Apply grease to the new o-ring (21, Figure 31) and slide it in place on the cap (20). Coat the two 3/8-16 x 7/8 inch long capscrews (18) with viscous coating VC-3. Seat the bearing cup (26) on the bearing cone (27). Install the cap (20) and shims with the two capscrews and lockwashers (19). Torque the capscrews to 20 foot-pounds.
4. Install the bearing cone (42, Figure 31) and cup (41) on the right end of the input shaft. The bearing is not a press fit and should slide freely on the shaft.
5. Install the cap (36) and shims (37, 38, 39, 40) removed at disassembly to the transmission case with the two 3/8-16 x 7/8 inch long capscrews (18) and lockwashers (19). Tap the bearing cap to make sure the bearing is seated on the input shaft; then, torque the capscrews to 20 foot-pounds. If the end-play is correct, the input shaft will turn with a slight resistance, and the spacers can just be rotated with no shaft movement. If the fit is too tight or loose, remove or add an appropriate shim. Replace the cap and check end-play.
6. When the correct number of shims is determined, coat them with sealer. Apply viscous coating VC-3 to the two 3/8-16 x 7/8 inch long capscrews (18, Figure 31). Install the cap (36) and shims to the transmission case using the two capscrews and washers. Torque the capscrews to 20 foot-pounds.
7. Place the gear (9, Figure 31) inside the transmission case, and carefully insert the right end of the gear shaft (8) through the retaining cap (3) hole and through the gear. Slide the gear (7) through the retaining cap hole and install the gear on the gear shaft.
8. Seat the bearing cone (6, Figure 31) on the gear shaft and press the bearing cup (5) in the retainer cap (3). Apply grease to the new o-ring and slide it in place on the retainer cap. Apply viscous coating VC-3 to the two 3/8-16 x 7/8 inch long capscrews (1). Install the retainer cap to the transmission case with the two capscrews and lockwashers (2). Torque the capscrews to 20 foot-pounds.
9. Install the bearing cone (17, Figure 31) and cup (16) on the right end of the gear shaft. The bearing is not a press fit and should slide freely on the shaft.

10. Install the cap (12, Figure 31) and shims (13, 14, 15) removed at disassembly to the transmission case with the two 3/8-16 x 7/8 inch long capscrews (10) and lockwashers (11). Tap the bearing cap to make sure the bearing is seated on the gear shaft; then, torque the capscrews to 20 foot-pounds. The gear shaft must clear the cap (12) and rotate freely. If the fit is too tight or loose, remove or add an appropriate shim. Replace the cap and check the end-play.
11. When the correct number of shims is determined, coat them with sealer. Apply viscous coating VC-3 to the two 3/8-16 x 7/8 inch long capscrews (10, Figure 31). Install the cap (12) and shims to the transmission case using the two capscrews and washers. Torque the capscrews to 20 foot-pounds. The shaft should have slight resistance when rotated.
12. Place a film of grease on the o-rings (8, 9, Figure 30) and install them on the shift shaft assembly (18). Coat the gasket (15) with sealer and install it on the shift shaft assembly. Coat the two spacers (18) with sealer and position them in the transmission case.
13. Insert the spring (5, Figure 30) and ball (6) in the shift fork (7) and hold them in place with 7/16 x 1 inch bolt. Position the fork inside the transmission case, and then, insert the shift shaft through the transmission case and shift fork. Remove the bolt as the shaft passes over the ball. Insert the remaining spring and ball in the shift fork (4) and install on the shift shaft as outlined above.
14. Secure the shift shaft assembly with the two 3/8-16 x 3/4 inch long capscrews (11, Figure 30), coated with sealer, and the two lockwashers (12).
15. Install the shift guide (3, Figure 30) with the two 1/4-20 x 1 inch long capscrews (13) and lockwashers (14).
16. Install a new seal (19, Figure 30) in the transmission case. Align the shift stem (2) through the shift guide on the shift shaft assembly (1). Secure the stem on the shaft with the 5/16-18 x 1 inch long capscrew (21) and lockwasher (20).
17. Replace the PTO final drive shaft. Refer to PTO Final Drive for installation procedures. Install the hydrostatic unit using the two flange nuts.
18. Install a new gasket on the transmission case. Secure the transmission case cover with the mounting capscrews and lockwashers. On 9020 tractors with Manufacturing No. 1690072, retain the two 3/8-16 x 1 inch long capscrews (6, Figure 29) and lockwashers (7) used in mounting the seat adjuster assembly
19. Reinstall the elbow and the transmission temperature sending unit in the transmission case.

Transmission Installation

1. Use a hoist to position the transmission case and hydrostatic unit on the tractor frame. Secure it with the two capscrews and lockwashers.
2. Install the cotter pins (19, Figure 20) and pins (20) to secure the rear brake rods (21) to the brake levers (33).
3. Install the brake assemblies, drop housings, and rear wheels. Refer to Wheels and Drop Housings, and Brakes for installation procedures. Remove the tractor from the stand.
4. Connect the hydrostatic pump inlet elbow to the hose from the oil filter. Attach the electrical connection to the transmission temperature sending unit. Attach the hydrostatic control arm and the hydrostatic unit-to-valve tube assembly to the hydrostatic unit.
5. Install the rear coupling (47 or 69, Figure 26) with the two 3/8-16 x 1 inch long capscrews (42 or 65) and washers (29 and 43 or 66 and 67) and the two shoulder bolts (41 or 72), washers (43 or 71 and 70), and nuts (49). If a rear PTO shaft must be connected, align the electric clutch with the PTO shaft hub and secure it with the four 5/16-18 x 1 inch long taptite screws. Check and adjust runout on rear PTO shaft using a dial indicator if it was disassembled (see Figure 35).
6. Make the necessary adjustments to the brake linkage. Refer to Brake Adjustment under General Information.
7. Fill the transmission case and hydrostatic unit with transmission fluid. Refer to Transmission Fluid and Filter, and Transmission Priming Procedure under General Information.

NOTE

Make certain the hydrostatic system is primed before operating the tractor.

8. Replace cover assembly and bottom cover.
9. Install the seat and seat adjuster assembly on 4040, 4041, Pow'r Max tractors, and on 9020 tractors with Manufacturing No. 1690072 by attaching the seat adjuster assembly to the transmission cover with the four 3/8-16 x 1 inch long capscrews and lockwashers.

   On 9020 tractors with Manufacturing No. 1690230 or 1690283, install the seat supports using the four 1/2-13 x 1-12 inch long capscrews (11, Figure 27) and lockwashers (6). Secure the seat springs (8) to the seat support (9) studs with the two adjusting knobs (1), hex nuts (2), washers (3, 4, 5) and spacers (7).

DIFFERENTIAL

Differential Removal and Disassembly (Figure 33)

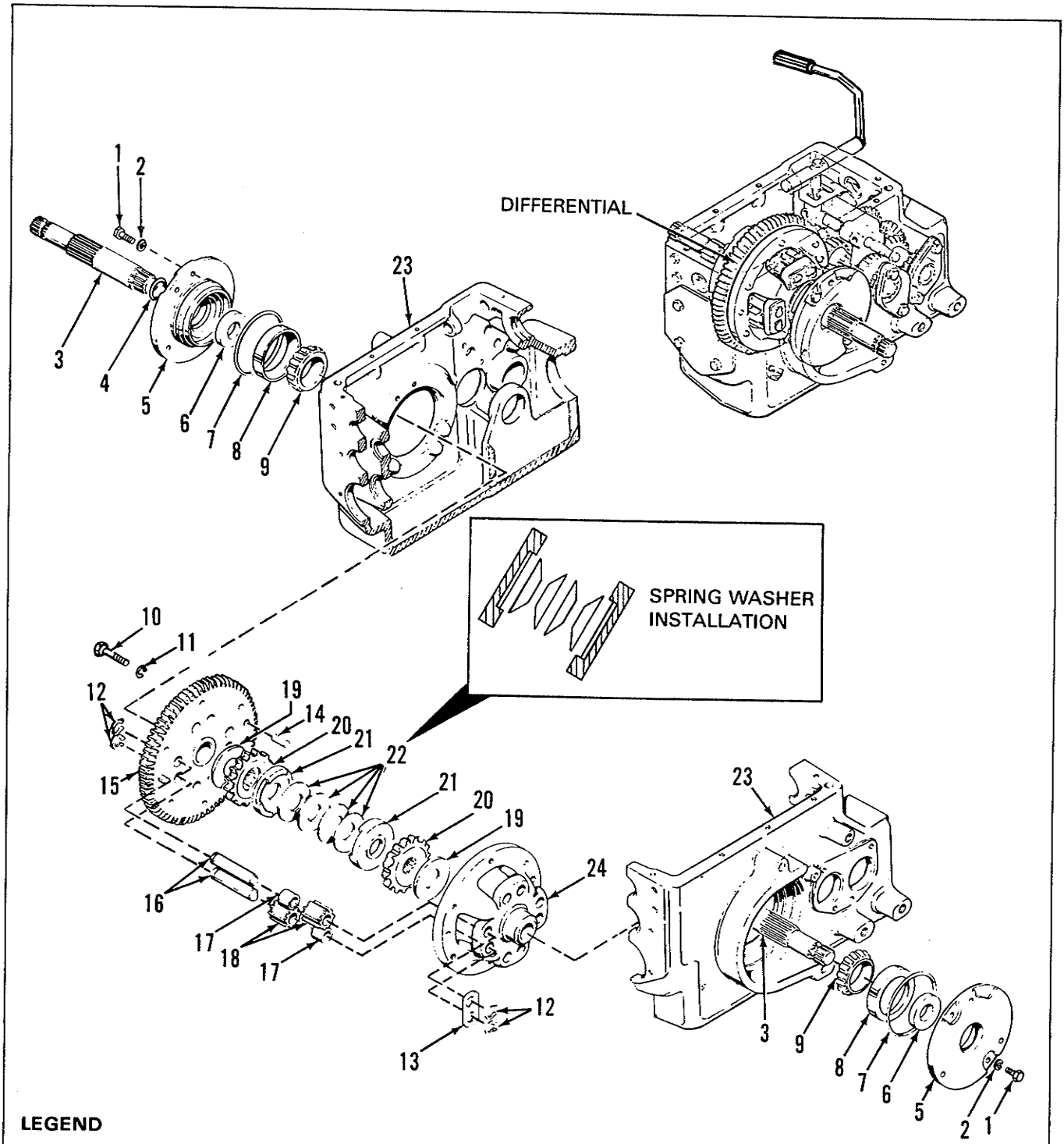
1. Remove the differential assembly
   a. Remove the case as outlined in Transmission Removal and Disassembly, steps 1a through 1j.
   b. Remove the differential supports (5) from the transmission case by removing the four 5/16-18 x 3/4 inch long capscrews (1) and lockwashers (2). Remove the seals (6), o-rings (7), and bearing cups (8) from the supports. Discard the seals and o-rings. Remove the top stationary stud only for clearance. Remove the other stationary studs only if they must be replaced.
   c. Carefully remove the differential assembly from the transmission case.
2. Disassemble the differential assembly.
   a. Inspect the bearing cones (9) and if either one is defective, remove it from the gear assembly hub with a bearing puller.
   b. Remove the retaining rings (12) and lock plates (13) from the pinion shafts (16).
   c. Carefully remove the six 3/8-16 x 1-1/4 inch long capscrews (10) and lockwashers (11) in opposing pairs to prevent the spring washer assembly from cocking the gear assembly. The pins (14) are pressed into the gear at assembly and need not be removed unless repair is required. The pins should extend 1/2 inch from the gear.
   d. Note the locations of the pinion gears (18) and spacers (17) on the pinion shafts (16) and remove the eight gears, spacers and shafts.
   e. Remove the two thrust washers (19), clutches (20), and the four spring washers (22) from the gear carrier (24).

Inspection, Cleaning, and Repair of the Differential

1. Wash all parts with cleaning solvent and dry thoroughly with compressed air. Do not spin bearings with compressed air. Check the bearings for looseness, wear, roughness, pitting and scoring. Replace them if necessary. Refer to Bearing Cleaning and Inspection under General Information.
2. Check all gears and shafts for wear and burrs. Replace all damaged parts.
3. Inspect the transmission case for cracks or raised places on machined surfaces.
4. Replace all oil seals and o-rings.
5. Lubricate all parts thoroughly before installation.

Differential Assembly and Installation (Figure 33)

1. Assemble the differential assembly.
   a. If a bearing cone (9) and/or cup (8) is to be replaced, seat the replacement part with the old cone or cup and install on the gear assembly hub (15) or gear carrier (24).
   b. Assemble the spring washers (22), clutches (21), gears (20) and thrust washers (19) in the gear carrier as shown. Be sure the two outer spring washers are positioned so their outer edges face outward. The two inner spring washers must face inward.
   c. Install one lock plate (13) on two pinion shafts (16) and secure it with two retaining rings (12). Insert the plate shaft assembly in the gear carrier and repeat the procedure with the remaining pinion shafts and lock plates.



LEGEND

1. Capscrew
2. Washer, lock
3. Shaft, input
4. Ring, retaining
5. Support
6. Seal
7. O-Ring
8. Cup, bearing
9. Cone, bearing
10. Capscrew
11. Washer, lock
12. Ring, retaining
13. Plate, lock
14. Pin
15. Gear assembly
16. Shaft, pinion
17. Spacer
18. Gear, pinion
19.. Washer, thrust
20. Gear, differential
21. Clutch, differential
22. Washer, spring
23. Case, differential
24. Carrier, gear

Figure 33. Differential

d. Place four pinion gears (18) on alternate pinion shafts (16) and place four spacers (17) on the remaining shafts. Repeat the procedure by placing gear on spacer and spacer on gear.

e. Align the gear assembly (15) on the gear carrier (24) with the two pins (14). Carefully secure the gear assembly by installing the six 3/8-16 x 1-1/4 inch long capscrews (10) and lockwashers (11) in opposing pairs. Secure the pinion shafts on the gear assembly side with the retaining rings.

2. Install the differential assembly.

a. Place the differential assembly in the transmission case.

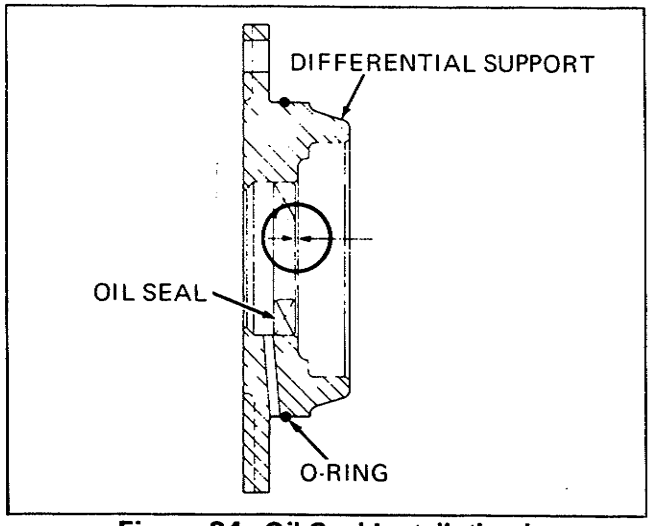


Figure 34. Oil Seal Installation in Differential Support

b. Coat new seals (6) with VC-3 and let dry. Install new seals (6) and o-rings (7) on each support (5). The oil seals must be installed to a dimension location as shown in Figure 34. Press the bearing cups (8) into each support.

c. Secure the supports (5) to the transmission case with the four 5/16-18 x 3/4 inch long capscrews (1) and lockwashers (2).

⚠ CAUTION

It is very important to make sure that the supports are fully seated in their cavities before tightening the capscrews or the casting may break.

d. Install the transmission case as outlined in Transmission Installation, steps 1 through 9.

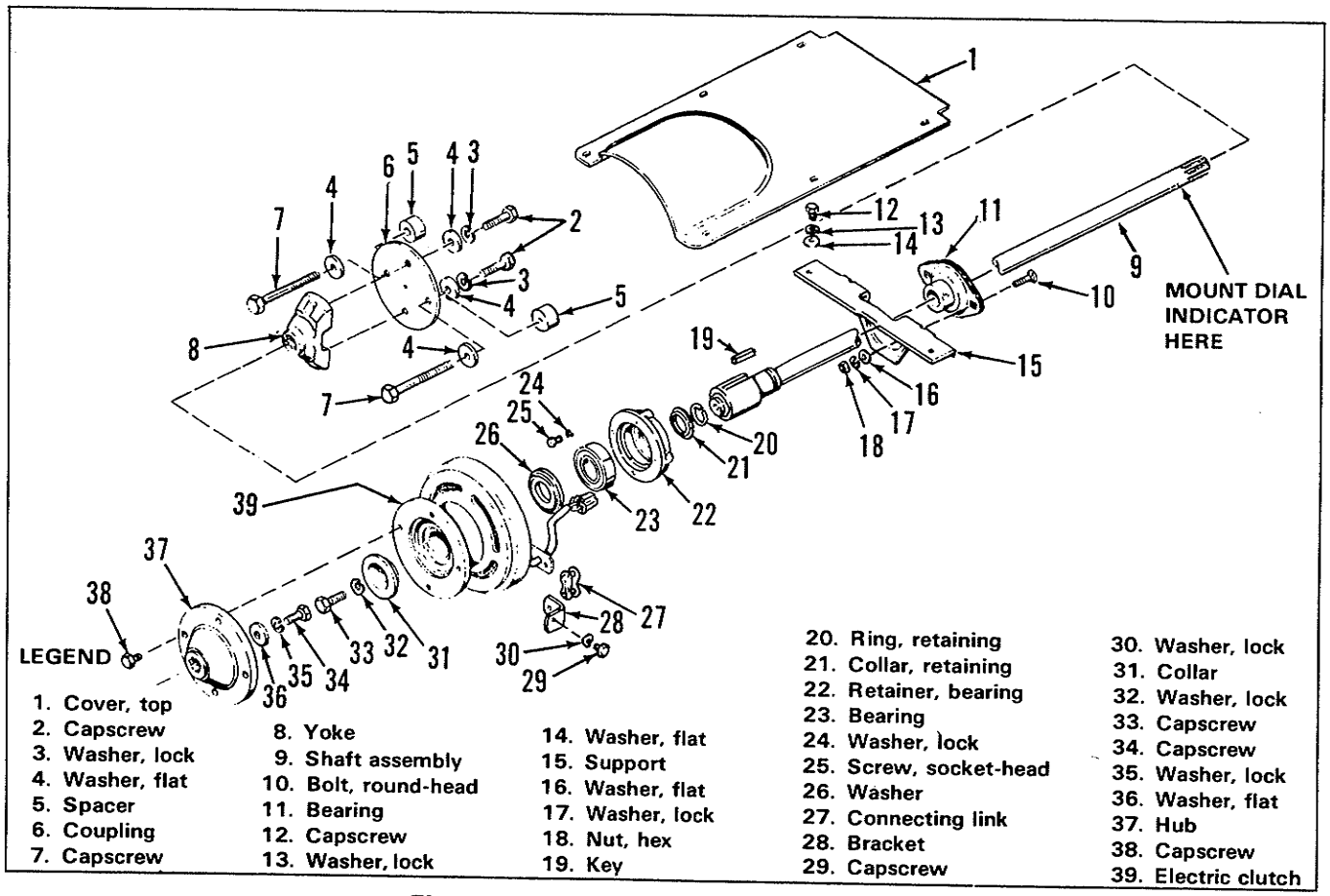
REAR PTO

Description

The rear PTO drive unit consists of components from the engine pulley to the differential case. The rear PTO final drive consists of the components inside the transmission case.

PTO Drive Unit Removal (Figures 35 and 36)

1. Disconnect the battery.
2. Remove the cover plate.
3. Remove the seat and attaching parts. Refer to Transmission Removal and Disassembly for removal procedures.
4. Disconnect the rubber fuel lines at the fuel tank. Open the clamps that hold the fuel lines fully before moving them.
5. Remove the two capscrews and four washers mounting the oil cooler. Carefully lift the oil cooler up and toward the right side of the tractor making sure not to break the transmission oil hose connections. Handle the oil cooler with care.
6. Remove the four capscrews securing the left and upper engine shrouds and remove the shrouds.
7. Remove the steering wheel and its rubber washer by removing the 5/16-18 x 1-1/4 inch long capscrew and locknut securing them to the steering shaft.
8. Remove the six screws attaching the instrument panel assembly to the body assembly support. Carefully lift the panel up and over the steering shaft using caution not to disconnect or break the instrument wire connections.
9. Remove the left and right panel assemblies by removing the six 1/4-20 x 3/8 inch long screws.
10. Remove the remaining screws holding the body assembly support to the support assembly. Disconnect the ignition switch from the wiring harness and remove the body assembly support from the tractor.
11. Remove the clutch bracket capscrew (29, Figure 35; 25, Figure 36) and lockwasher (30, Figure 35; 26, Figure 36). Disconnect the clutch electrical connections. On the 4040 tractor, remove the two capscrews (12, Figure 35), lockwashers (13), and flatwashers (14) securing the bearing support (15) to the frame.



LEGEND

1. Cover, top
2. Capscrew
3. Washer, lock
4. Washer, flat
5. Spacer
6. Coupling
7. Capscrew
8. Yoke
9. Shaft assembly
10. Bolt, round-head
11. Bearing
12. Capscrew
13. Washer, lock
14. Washer, flat
15. Support
16. Washer, flat
17. Washer, lock
18. Nut, hex
19. Key
20. Ring, retaining
21. Collar, retaining
22. Retainer, bearing
23. Bearing
24. Washer, lock
25. Screw, socket-head
26. Washer
27. Connecting link
28. Bracket
29. Capscrew
30. Washer, lock
31. Collar
32. Washer, lock
33. Capscrew
34. Capscrew
35. Washer, lock
36. Washer, flat
37. Hub
38. Capscrew
39. Electric clutch

Figure 35. Rear PTO Drive Unit (4040)

12. Block the clutch hub with a large wrench or crowbar and remove the four 5/16-18 x 1 inch long taptite screws (38, Figure 35; 35, Figure 36) securing the clutch to the clutch hub.
13. Remove the two 3/8-16 x 3-1/2 inch long capscrews (7, Figure 35; 9, Figure 36), lockwashers (3, Figure 36), flat washer (4, Figure 35 and 36) and spacers (5, Figure 35 and 36) securing the PTO coupling to the engine flywheel.
14. On the 4040 tractor, loosen the yoke setscrew. Then, on all tractors, separate the shaft assembly (9, Figure 35; 15, Figure 36) from the yoke (8, Figure 35; 10 Figure 36) and remove the PTO drive unit, then the coupling assembly from the tractor.

PTO Drive Unit Disassembly (Figures 35 and 36)

1. Where used, remove the felt (13, Figure 36) and rubber washer (14), from the shaft assembly.
2. Remove the two bolts (2, Figure 35; 12, Figure 36), flat washers (4, Figures 35 and 36), lockwashers (3, Figures 35 and 36), and hex nuts (2, Figure 36) securing the coupling (6, Figures 35 and 36) to the yoke.
3. Remove the grease fittings (11, Figure 36) and plug (7) from the yoke, and press the bushings (8) from the yoke only if they are to be replaced.
4. On the 4040 tractor, loosen the bearing collar set screw and slide the bearing (11, Figure 35) and bearing support (15) off the end of the shaft (9). Remove bearing from the support only if it must be replaced.
5. Remove the 3/8-16 x 1-1/4 inch long capscrew (33, Figure 35; 30, Figure 36) and lockwasher (32, Figure 35; 29, Figure 36) securing the clutch collar (31, Figure 35; 28, Figure 36) to the clutch (39, Figure 35; 27, Figure 36). Remove the collar.
6. On the 4040 tractor move the shaft forward to expose the retaining ring (20, Figure 35) on the bearing end of the clutch. Pry the retaining ring and bearing retaining collar (21) from the bearing retainer (22) and slide the bearing (23) from the shaft.

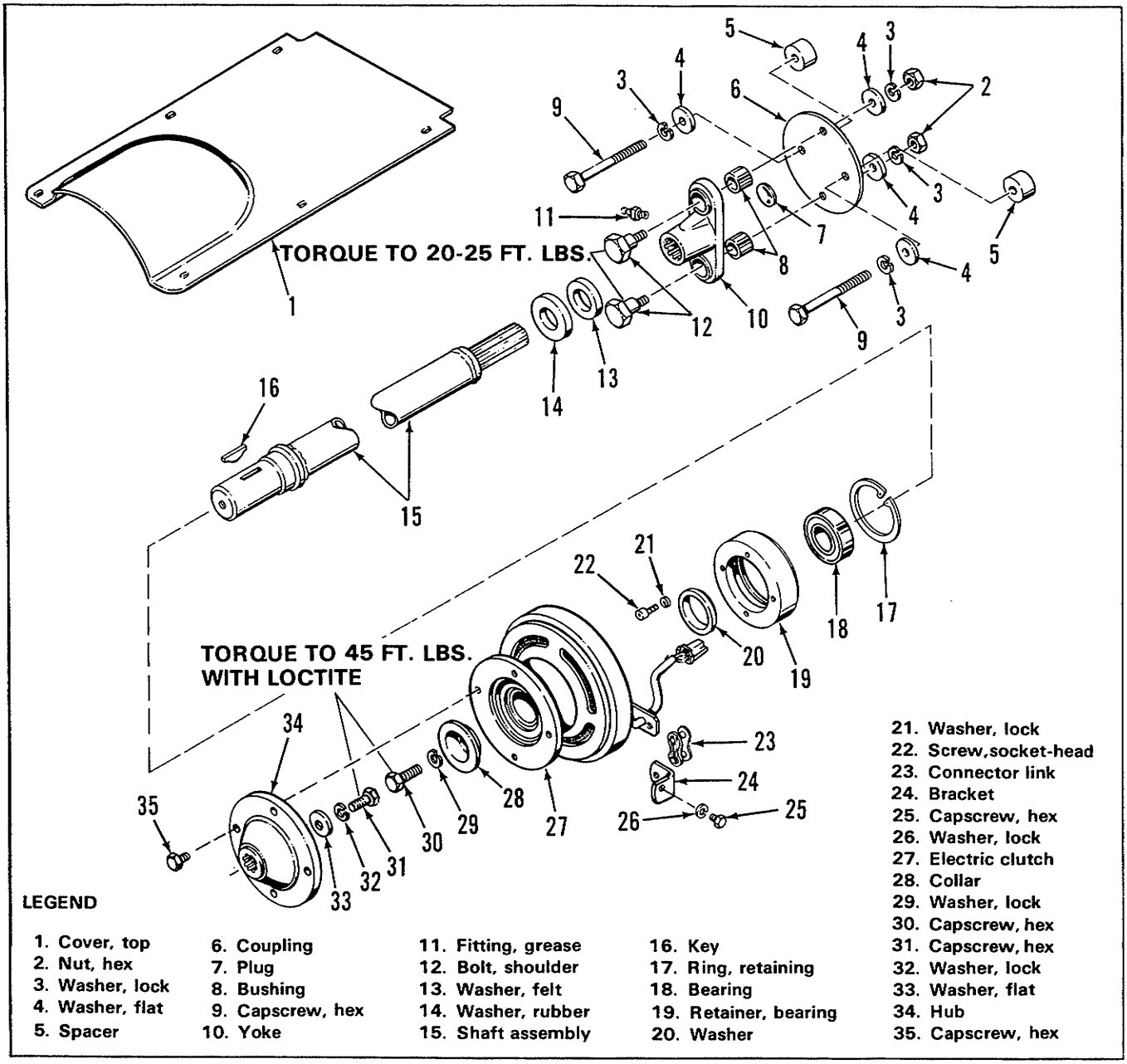


Figure 36. Rear PTO Drive Unit (4041, Pow'r Max, 9020)

7. Use a gear puller around the clutch to remove it from the shaft. Remove the key (19, Figure 35; 16, Figure 36) and washer (26, Figure 35; 20, Figure 36) from the shaft. On all tractors but the 4040, remove the bearing retainer (19, Figure 36). Remove bearing from the retainer only if it must be replaced.

PTO Drive Unit Inspection

1. Wash all parts with cleaning solvent and dry them thoroughly.
2. Check bearing for looseness, wear, roughness, pitting or scoring. Replace if necessary. Refer to Bearing Cleaning and Inspection under General Information.
3. Check shaft for wear or burrs. Replace if necessary.
4. Inspect the electric clutch assembly for any worn or damaged components and replace if necessary.

5. Replace retaining ring and washers that are worn or damaged.

PTO Drive Unit Assembly (Figures 35 and 36)

1. On all tractors but the 4040, assemble the bearing (18, Figure 36) and retaining ring (17) in the bearing retainer (19) if they were removed, and install the retainer on the shaft (15). Then install the key (16), washer (20) and clutch (27) on the shaft.
2. On the 4040 tractor, install the key (19, Figure 35) in the clutch (39). Install the washer (26) between the clutch field and armature assemblies. Assemble the clutch and carefully tap the assembly on the shaft (9). Install the bearing (23) in the bearing retainer (22), install the bearing and retainer on the shaft, and secure the retainer with the retaining ring (20) and retaining collar.
3. Secure the clutch collar (31, Figure 35; 28, Figure 36) to the clutch with the 3/8-16 x 1-1/4 inch long capscrew (33, Figure 35; 30, Figure 36) and lockwasher (32, Figure 35; 29, Figure 36). Apply Loctite to the capscrew and torque it to 45 foot-pounds.
4. If the bushings (8, Figure 36) were removed from the yoke, press in new ones. Install the grease fitting (11) and plug (7) in the yoke, if they were removed.
5. On the 4040 tractor, install the bearing (11, Figure 35) in the bearing support (15) if it was removed, and install the bearing and bearing support on the shaft. Tighten the bearing collar setscrew.
6. Secure the coupling (6, Figures 35 and 36) to the yoke (8, Figure 35; 10, Figure 36) with the two bolts (2, Figure 35; 12, Figure 36) flat washers (4, Figures 35 and 36), lockwashers (3, Figures 35 and 36), and hex nuts (2, Figure 36). Torque the bolts to 20-25 foot pounds on the 4040 tractor, and to 25- 30 foot-pounds on all other tractors.
7. Where used, install the felt (13, Figure 36) and rubber (14) washers on the shaft.

PTO Drive Unit Installation (Figure 35 and 36)

1. Hold the coupling assembly in place in the tractor, and then insert the shaft assembly in the tractor. Install the coupling assembly on the shaft. Align the clutch bracket (28, Figure 35; 24, Figure 36) with the mounting hole in the tractor frame.
2. Block the clutch hub with a large wrench or crowbar and secure the clutch to the clutch hub with the four 5/16-18 x 1 inch long taptite screws (38, Figure 35; 35, Figure 36).
3. Secure the clutch bracket to the frame with the capscrew (29, Figure 35; 25, Figure 36) and lockwasher (30, Figure 35; 26, Figure 36). Connect the clutch wiring.
4. Attach the coupling, through the input pulley, to the engine flywheel with the two 3/8-16 x 3-1/2 inch long capscrews (7, Figure 35; 9, Figure 36), washers (3, Figure 36), flat washers (4, Figures 35 and 36), and spacers (5, Figures 35 and 36).
5. Use a dial indicator to check the runout near the splined front end of the shaft (see Figure 35). If runout exceeds 0.020 of an inch, reposition the shaft by tapping the yoke (8) until the runout falls below 0.020.
6. Torque the capscrews to 25-30 foot-pounds.

⚠ CAUTION

Torquing over 30 foot-pounds may strip the threads in the flywheel.

7. On all tractors but the 4040, lubricate the shaft through the grease fitting on the yoke with general purpose automotive grease.
8. Plug the ignition switch wire socket into the switch, and secure the body assembly support to the support assembly with the mounting screws. Install the left and right panel assemblies using the six 1/4-20 x 3/8 inch long screws.
9. Install the instrument panel assembly to the body support assembly using the six mounting screws.
10. Install the rubber washer and steering wheel on the steering shaft. Secure the wheel to the shaft using the 5/16-18 x 1-1/4 inch long capscrew and locknut.
11. Install the left and upper engine shrouds.
12. To reinstall the oil cooler, loosely install one capscrew and metal washer on the oil cooler's right side. Then on the left side, place one rubber washer above the cooler and the other below it and loosely attach the remaining capscrew and metal washer. Carefully push the oil cooler down so it is firmly seated and tighten the capscrews.
13. Connect the rubber fuel lines at the fuel tank.
14. Install the seat and attaching parts. Refer to Transmission Installation for installation procedures.
15. Install the cover plate.
16. Connect the battery.

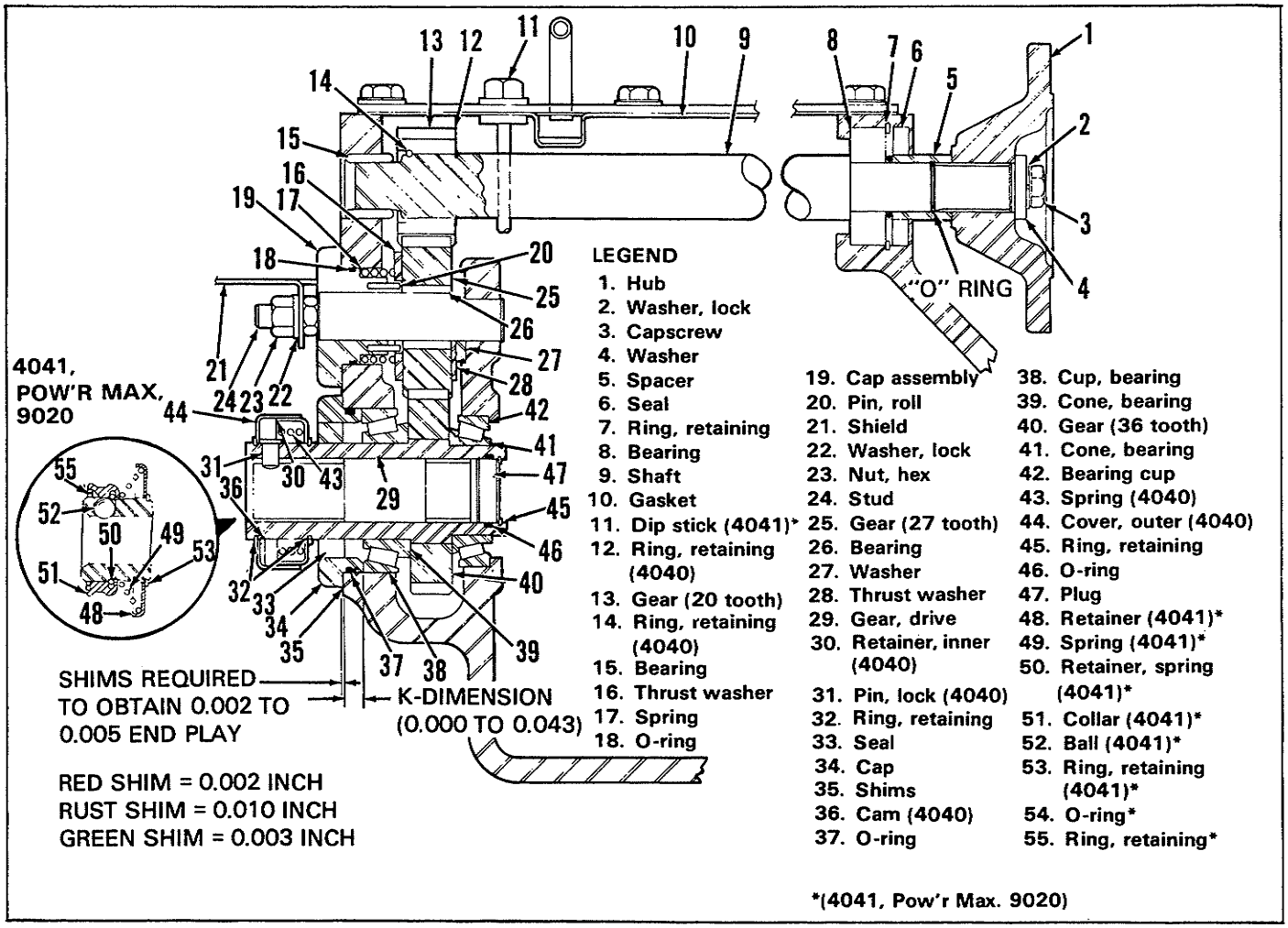


Figure 37. Rear PTO Final Drive

Rear PTO Drive Unit Kit 103297

This kit is used to replace defective or malfunctioning parts on the 4040 tractor PTO drive unit. Use the procedures pertaining to installation of components shown in Figure 36.

Item	Qty.	103297 Kit No.
Yoke	1	175229
Capscrew	2	923938
Coupling	1	175230
Bolt	2	108412
Shaft	1	176046
Key	1	176650
Retaining ring	1	176049
Retainer	1	1650720
Bearing	1	176050
Washer	1	176048
Washer	2	157424
Lockwasher	2	916965
Washer	4	153052
Spacer	2	172539
Bushing	2	177943
Jam nut	2	917421
Grease fitting	1	912808
Plug	1	177134
Felt washer	1	177141
Rubber washer	1	172266

FINAL DRIVE (Figure 37)

1. Remove the rear PTO drive unit from the tractor.
2. Remove the 3-point hitch if it is installed on the tractor.
3. Remove the bottom cover.
4. Disconnect the hydrostatic pump inlet hose from the elbow on the transmission case and the electrical connection from the transmission temperature sending unit.

5. Place a suitable container under the transmission case, and remove the dipstick assembly, elbow, and temperature sending unit allowing the transmission oil to drain from the case. After the oil has completely drained, install the elbow and temperature sending unit, attach the inlet hose to the elbow, and connect the transmission temperature sending unit electrical connection.
6. Remove the capscrews and lockwashers securing the transmission case cover. Lift the cover from the case and remove the gasket.

The rear PTO final drive unit consists of three major assemblies: Drive Shaft; Intermediate Gear; and Final Gear. Each assembly must be removed in the order outlined below. The transmission case may remain on the tractor.

Drive Shaft Assembly Removal and Inspection (Figure 37)

1. Remove the hub (1) from the final drive shaft (9) by removing the capscrew (3) and washer (4). Remove the spacer (5), O-ring (54), and seal (6) from the shaft.
2. Use a retaining ring pliers to remove the retaining ring (7) from the transmission case.
3. Pry the drive shaft (9) from the rear of the transmission case. Remove the bearing from the shaft using a suitable tool. Then remove the drive shaft through the transmission case cover hole.
4. Remove the bearing (15) from the transmission case using a suitable tool.
5. Clean bearings with naptha, kerosene, or a petroleum solvent. Inspect the bearing for ease of running; cracks or dents; and for flecked, pitted, or scratched areas on the balls, rollers or races. Replace as required. The bearings should be greased or oiled immediately after inspection.
6. Wash all remaining parts with cleaning solvent and dry with compressed air.
7. Check the gear and shaft for wear, cracks and burrs. Replace any parts as required. Lubricate the gear before reassembly.
8. Check for any damaged or worn retaining rings and replace if necessary.
9. Replace the oil seal and 0-ring.

Intermediate Gear Assembly Removal and Inspection (Figure 38)

1. Remove the two hex nuts and lock washers securing the shield to the stud-nut assemblies.

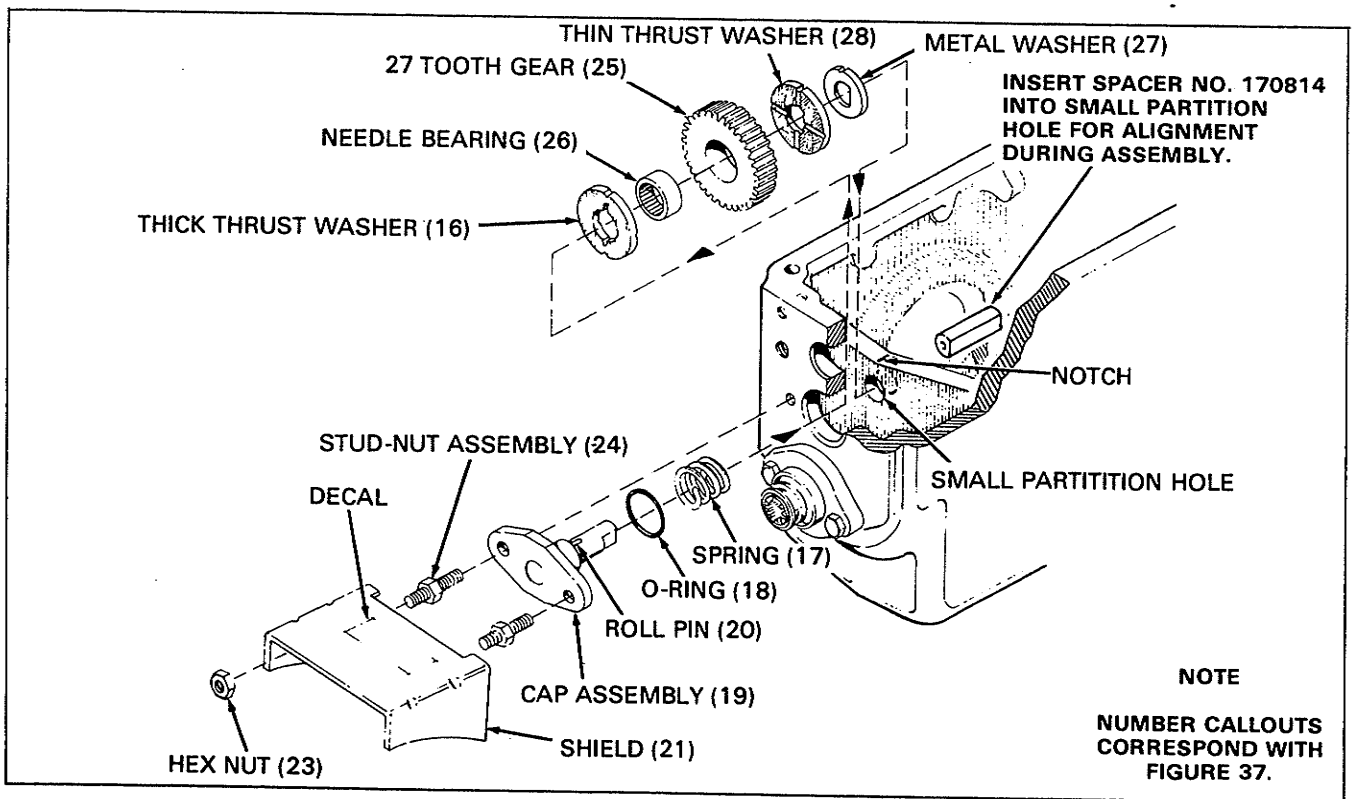


Figure 38. Intermediate Gear Removal and Installation

2. Remove the two stud-nut assemblies securing the cap assembly to the transmission case.
3. Hold the 27 - tooth gear, washers, and spring in place and slide the cap assembly from the case. Remove the gear, washers, and spring.
4. Inspect the two roll pins in the cap, and replace them if they are damaged. Remove and discard the 0-ring from the cap.
5. Check the gear for wear, cracks, or burrs. Replace the gear if necessary. Lubricate the gear before reassembly.
6. Inspect the spring for distortion, weakness, or breaks and replace it if necessary.
7. Replace the thrust washers with new ones.

Final Gear Assembly Removal and Inspection (Figure 37)

1. On the 4040 tractor, remove the two retaining rings (32) securing the cover assembly to the final drive gear shaft. Remove the cover assembly and the three lock pins (31) from the shaft. Separate the cover assembly inner retainer (30) and outer cover (44) and remove the cam (36) and spring (43) from it.

   On all other tractors, remove the snap ring (55) and use a bearing puller to remove the retainer (48). Separate the collar (51), and spring (49) from the retainer. Remove the retaining ring (53) from the final drive gear shaft, and retain the three balls (52).
2. Remove the two capscrews and lockwashers securing the cap (34) to the case. Remove the cap and shims (35) from the case and separate the seal (33) and O-ring (37) from the cap.
3. Hold the 36-tooth gear (40) in place and slide the final drive gear shaft (29) and bearing cup (38) and cone (39) from the case. Remove the gear from the case. Slide the bearing cup off of the bearing cone. If the bearing cone must be replaced, remove it from the shaft using a suitable tool.
4. Remove the retaining ring (45), plug (47), and 0-ring (46) from the shaft only if they must be replaced.
5. Remove the bearing cup (42) and cone (41) from the transmission case only if it is necessary to replace them.
6. Wash all parts in cleaning solvent and dry with compressed air. Do not spin bearings with compressed air.
7. Check bearings for looseness, wear, roughness, pitting and scoring. Replace them if necessary. Lubricate the bearings before reassembly.
8. Inspect the gear and shaft for wear, cracks, or burrs. Replace the gear if necessary. Lubricate gear before reassembly.
9. Replace all O-rings and seals. Check for any damaged or worn retaining rings and replace them if necessary.
10. Inspect the spring for distortion, weakness, or breaks. Replace it if necessary.

Final Gear Assembly Installation (Figure 37)

1. If the inner bearing cup (42) was removed, use a long wood block and a hammer to carefully and evenly tap the inner bearing cup into the large transmission case partition hole. Seat the bearing cone in the bearing cup.

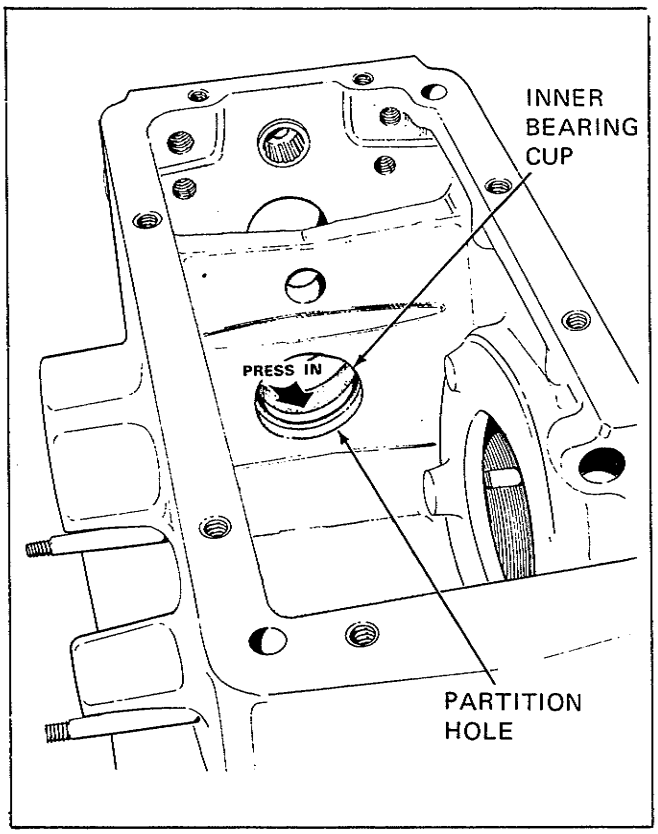


Figure 39. Final Gear Inner Bearing Installation

2. If the O-ring (46), plug (47), and retaining ring (45) were removed, install them in the final drive gear shaft (Figure 40).

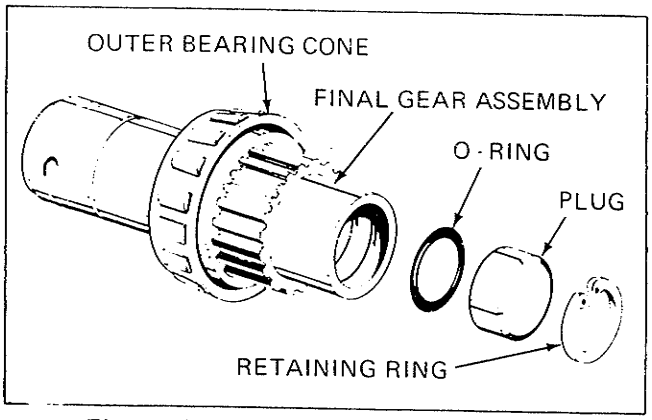


Figure 40. Final Gear Plug Installation

3. If the outer bearing cone (39) was removed, use the wood block and hammer to carefully and evenly tap the outer hearing cone on the final drive gear shaft. Tap it up flush against the side of the final drive gear (Figure 40).

4. Hold the 36-tooth gear in place with a channel lock pliers, and insert the final drive gear shaft through the large hole in the outer wall of the transmission case and the 36-tooth gear (Figure 41). Seat the end of the shaft in the inner bearing assembly

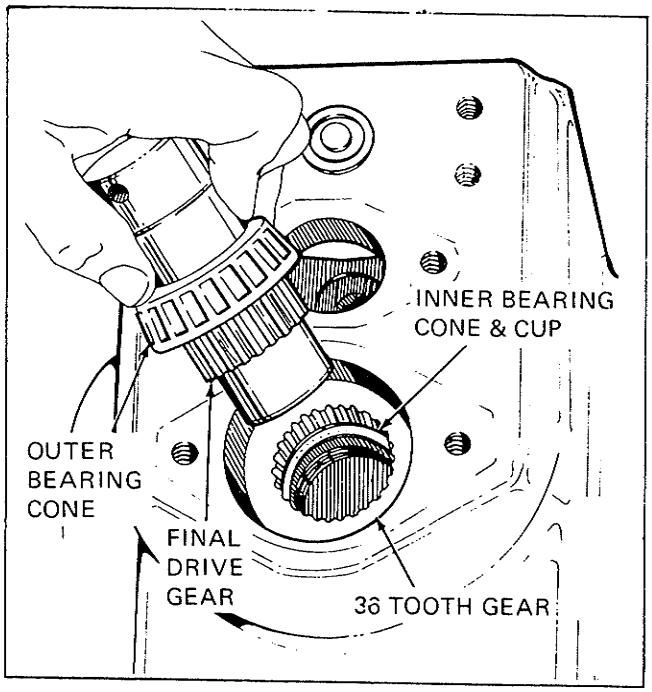


Figure 41. Final Drive Gear Installation

5. Carefully and evenly insert the outer bearing cup (38) in the final cone. Make sure the large diameter of the cup faces toward the bearing.

6. Install the new O-ring (37) on the cap and snug the cap to the case with the two capscrews and lockwashers. The cap should be flush against the outer bearing cup. It is necessary, however, to have 0.002 to 0.005 of an inch end-play between the cap and the outer bearing cup (Figure 42).

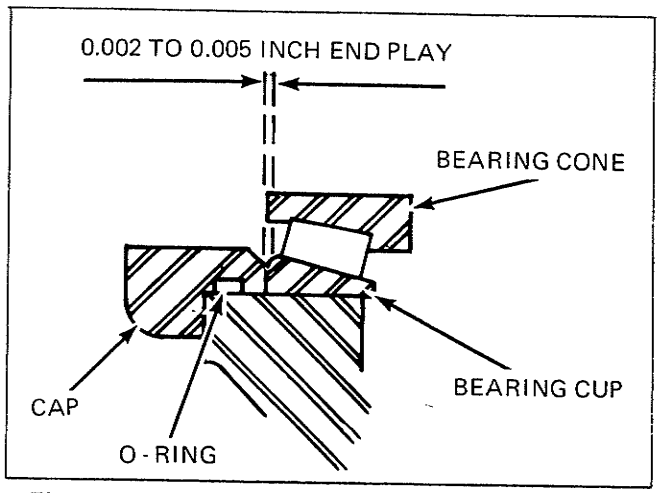


Figure 42. Final Gear Assembly Cap End Play

7. To establish required end-play, insert a tapered feeler gauge between the secured cap and the transmission case (Figure 43). The reading shown on the gauge plus 0.010 of an inch is the shimming required to obtain 0.002 to 0.005 of an inch end-play.

8. Remove the cap, and install the seal and required shims on it. Use the two capscrews and lockwashers to secure the cap to the transmission case, and torque them to 30 foot-pounds. Set up a dial indicator at the end of the gear and manually push and pull the gear after rotating. The indicator should read between 0.002 and 0.005 of an inch. If this is not the case, reshim as outlined above.

9. When the correct number of shims is determined, coat them with sealer. Apply viscous coating VC-3 to the two capscrews. Secure the cap, seal and shims to the transmission case with the two capscrews and lockwashers. Torque the capscrews to 30 foot-pounds.

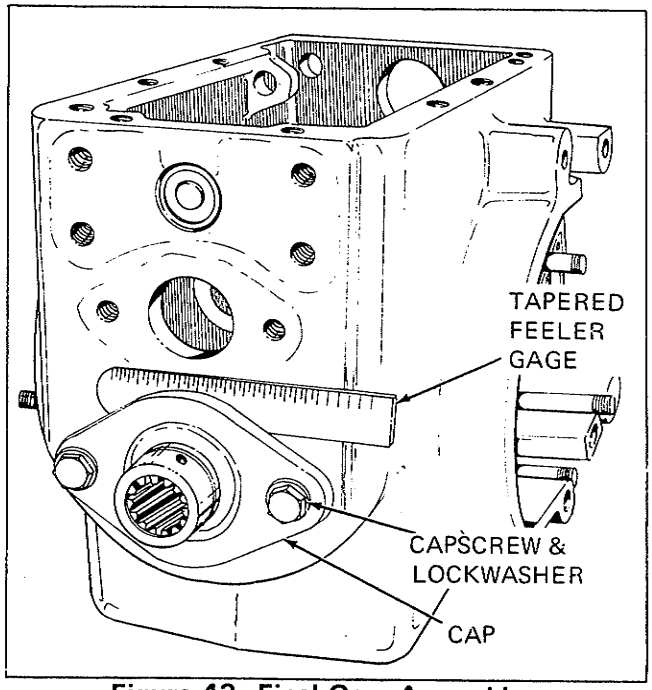


Figure 43. Final Gear Assembly Shimming Measurement

10. On the 4040 tractor, use a tru-arc pliers to install the inner retaining ring (32) on the shaft (Figure 44A). Slide the retainer (30) against the retaining ring and install the spring (43) and three lock pins (31) on the shaft. Compress the spring with the cam (36). Make sure the beveled inner diameter of the cam rides on lock pins. Install the outer cover (40) and secure it with the outer retaining ring (32).

    On all other tractors, use a tru-arc pliers to install the retaining ring (53) on the final drive gear shaft. Install the retainer (48) and spring (49) on the shaft and the spring in the concave side of the retainer. Apply grease to the three balls (52) and place the balls in the shaft holes. Compress the spring retainer (50) in the collar (51). Press the collar, with the spring retainer on its inside, against the spring until the balls pass over the spring retainer and the collar locks in position. Secure the collar with the outer retaining ring (55).

Intermediate Gear Installation (Figures 37 and 38)

1. Insert spacer #170814 (not part of this assembly) into the small partition hole in the transmission case (see Figure 38).

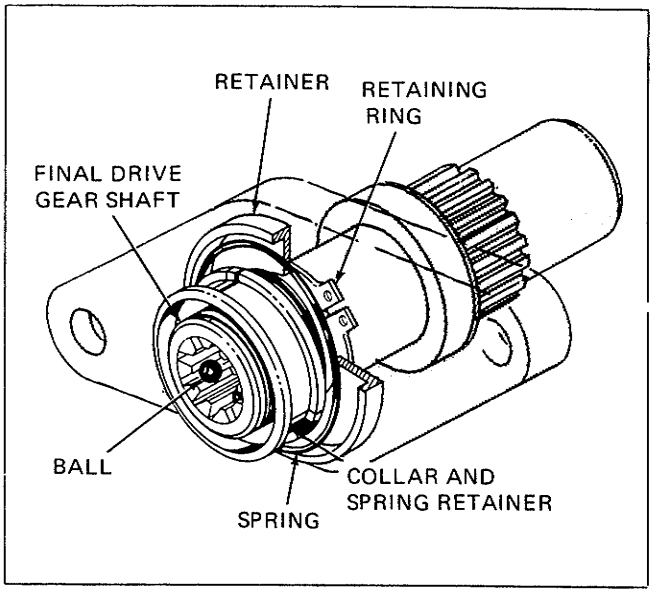


Figure 44. Locking Collar Installation

2. Make sure needle bearing (26) is clean and lightly lubricated with Type A or Dexron automatic transmission oil and then press it into the 27-tooth gear (25).
3. Slide metal washer (27), thin thrust washer (28), gear (25 and 26) and thick thrust washer (16) in that order between the transmission case wall and the partition and onto the spacer located in the small partition hole. Make sure that the thrust washers have their notches out and their grooves facing the gear.
4. Install new o-ring (18), the two roll pins (20) and the spring (17) on the cap assembly (19) (see Figure 38).

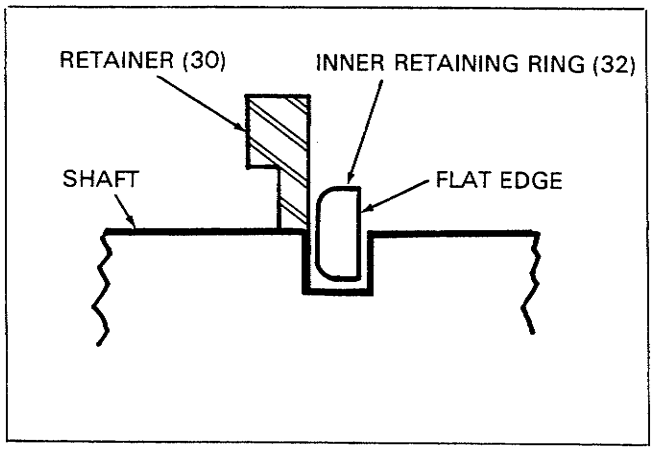


Figure 44A. Correct Retaining Ring Installation

NOTE

The thrust washers and metal washer's notches must align with the notch on the partition.

5. Insert the cap assembly, with the shaft's flat side to the right, through the transmission case, gear assembly, and partition hole, pushing spacer #170814 out.
6. Apply viscous coating VC-3 to the stud-nut assemblies (24). Secure the cap assembly to the transmission case with the stud-nut assemblies and torque them to 30 foot-pounds.
7. Install the shield (21) on the stud-nut assemblies using the two hex nuts (23) and lockwashers (22).

Drive Shaft Assembly Installation (Figure 37)

1. Press the bearing (15) into the transmission case.
2. Insert the shaft assembly in the transmission case. Press the gear end of the shaft into the bearing (15). Install the bearing (8) on the spline end of the shaft.
3. Install the bearing retaining ring (7) in the transmission case. Apply grease to the new O-ring and slide it in place on the shaft. Install a new seal (6) and slide the spacer (5) on the shaft end.
4. Install the hub (1) on the final drive shaft (9) using the capscrew (3) and washer (4). Apply Loctite to the capscrew, and torque it to 45 foot- pounds.

After the rear PTO Drive Shaft, Intermediate Gear, of Final Gear assemblies have been installed in the transmission case, the following procedures must be followed.

1. Install a new gasket on the transmission case. Secure the transmission case cover with the mounting capscrews and lockwashers. On 9020 tractors with Manufacturing No. 1690072, retain the two 3/8-16 x 1 inch long capscrews and lockwashers used in mounting the seat adjuster assembly.
2. Fill the transmission case through the dip stick opening with approximately six quarts of Type A, Type F, or Dexron automatic transmission oil. Install the dip stick.
3. Install the rear PTO drive unit. Refer to PTO Final Drive for installation procedures.
4. Install the bottom cover and the seat assembly.
5. Install the 3-point hitch if it is used on the tractor.

⚠ CAUTION

Make certain the hydrostatic system is primed before operating the tractor.

Transmission Priming Procedure (Figure 3)

1. Disconnect the B+ wire from the ignition coil.
2. Remove the cover assembly from the center console of the tractor.
3. Remove the pipe plug from the pump. Pour transmission oil through the pipe plug hole until it overflows.
4. Crank the engine using the battery until fluid flows from the pipe plug hole with no air bubbles. You may have to stop and add oil several times. Wipe up all spills.
5. Install the pipe plug and the cover assembly. Reconnect the B+ wire to the ignition coil.
6. Run the engine for a short period and check the oil level in the differential case. Add transmission oil if necessary.

STEERING AND FRONT AXLE ASSEMBLIES

Description (Figure 45)

The steering assemblies consist of the steering shaft assembly, the steering gear assembly, the drag link, and the tie rod. The front axle assembly is composed of the two hub assemblies, two spindles, and front axle.

Steering Gear Removal (Figure 47)

1. Disconnect the negative battery cable.
2. Remove the left and upper engine shrouds and the bottom cover.

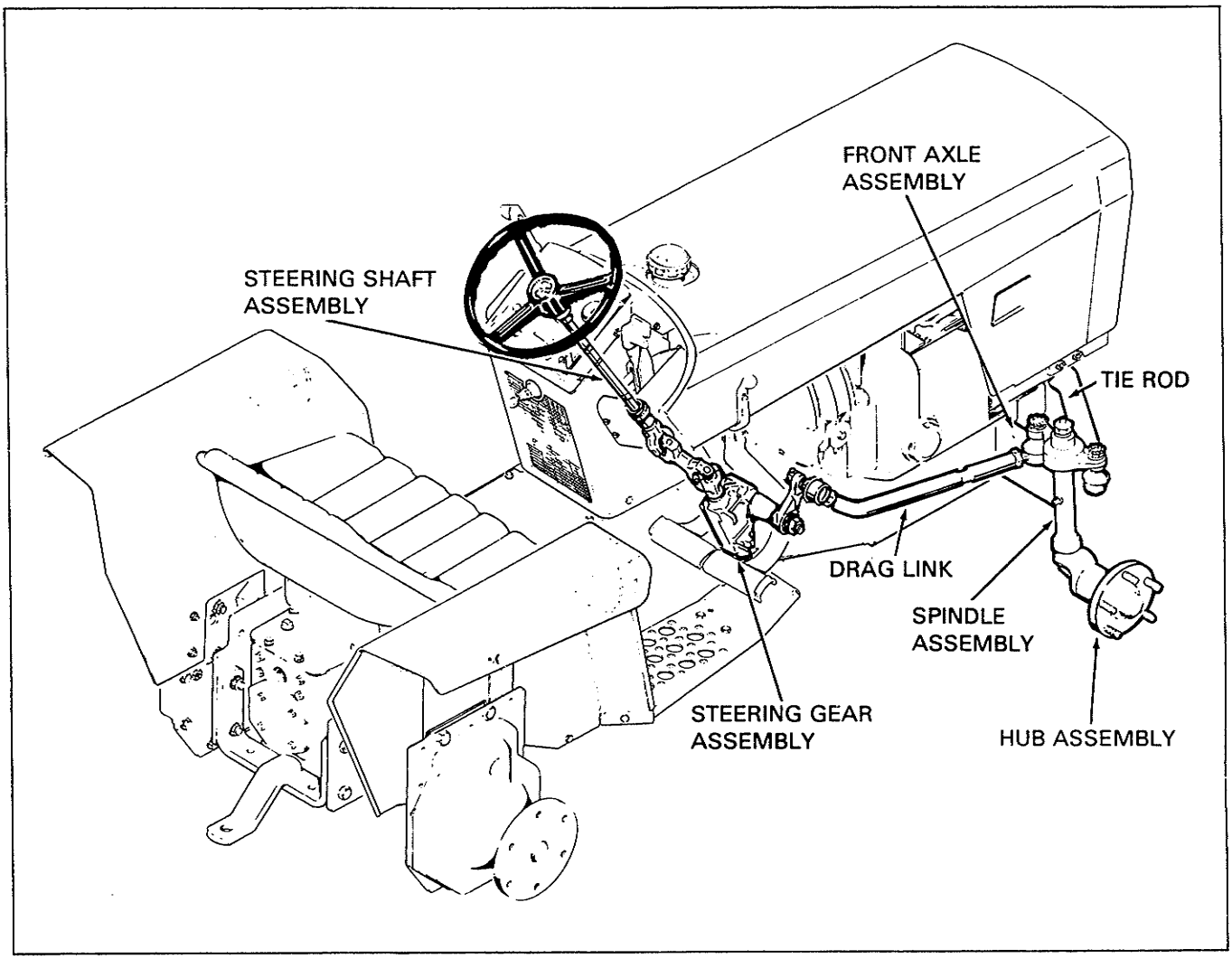


Figure 45. Steering and Front Axle Assemblies

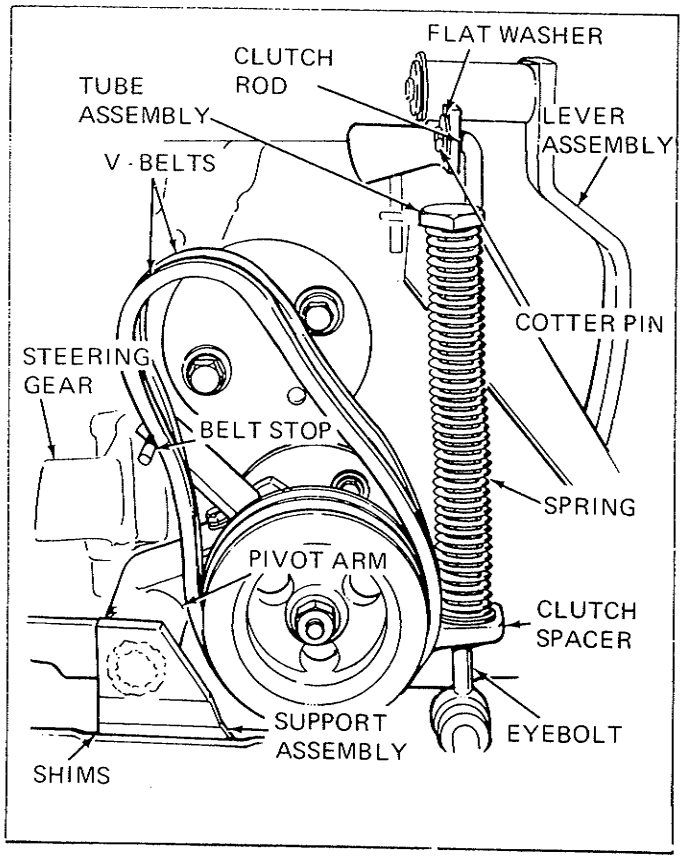


Figure 46. Steering Shaft and Gear Removal

3. Disconnect the rubber fuel lines at the fuel tank. Do not open the hose clamps any further than necessary. Then remove the fuel tank. Refer to Fuel Tank and Fuel Gauge Removal, Inspection, and Installation for removal procedures.

4. Remove the two capscrews and four washers mounting the oil cooler. Carefully lift the oil cooler up and toward the right side of the tractor making certain not to break the transmission oil hose connections. Handle the oil cooler with care.

5. Remove the PTO drive unit and the main-drive shaft. Refer to PTO Drive Unit Removal and Drive Shaft Removal for removal procedures.

6. Remove the two V-belts from the input pulley.

7. Remove the steering wheel and its rubber washer (2) by removing the 5/16 x 1-1/4 inch long capscrew (3) and locknut (4) securing them to the steering shaft.

8. Remove the spring clip from the choke cable at the carburetor and disconnect the cable. Remove the throttle and choke cables from the clips under the hydrostatic handle and fuel tank.

9. Remove the six screws attaching the instrument panel assembly to the body assembly support. Carefully lift the panel up and over the steering shaft using caution not to disconnect or break the instrument wire connections. Remove the roll pin (6) and pull the steering shaft up through the shaft support tube.

10. Remove the six screws and two speed nuts holding the left and right panel assembly to the body assembly support, and remove the panel assemblies.

11. Remove the remaining screws holding the body assembly support to the support assembly. Disconnect the ignition switch from the body assembly support, and remove the body assembly support from the tractor.

12. Disconnect the two tension springs from the left and right brakes' front link rods. Remove the cotter pin holding the right link rod to the right anchor.

13. Disconnect the clutch rod from the clutch lever assembly by removing the cotter pin.

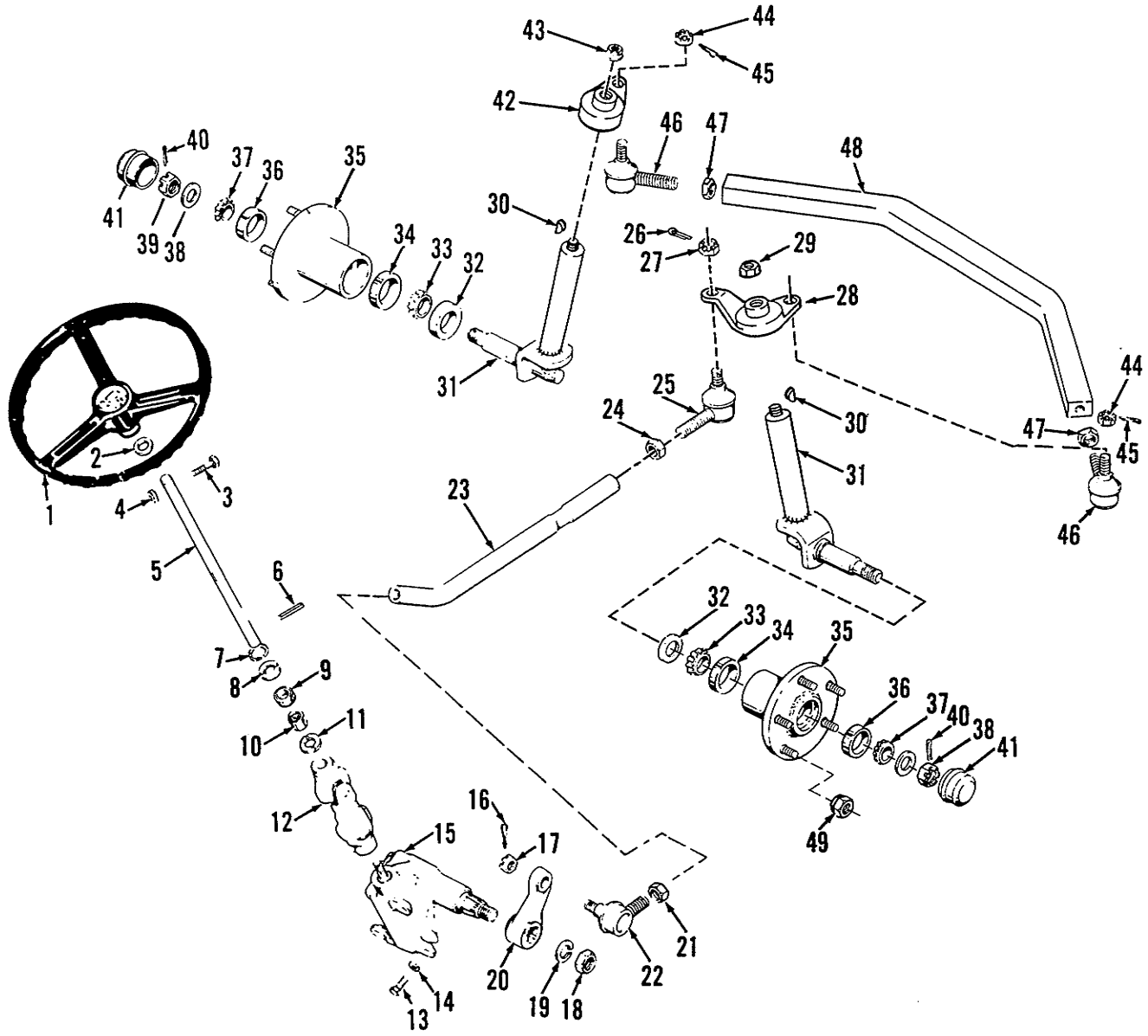
14. Disconnect the hydraulic valve linkage by removing the links between the bell cranks and the valve. Disconnect the control lever from the eye bolt by removing the nut and shoulder bolt.

15. Remove the two screws securing the control valve to the support assembly

16. Remove the three screws and the one 5/16-18 x 3/4 inch long capscrews, washer, lockwasher, and nut securing the support assembly to the tractor frame. Carefully remove the support assembly from the tractor.

17. Loosen the capscrew holding the belt stop assembly to the pivot arm.

18. Disconnect the support assemblies by removing the two 3/8-16 x 1-1/4 inch long capscrews and lockwashers. Tilt the pivot arm and support assemblies outward away from the steering gear. Remove the support assembly shims noting the quantity and location so they may be replaced in the same position.



LEGEND

1. Steering wheel
2. Washer
3. Capscrew
4. Nut, lock
5. Steering shaft
6. Pin, roll
7. Ring, retaining
8. Thrust washer
9. Bearing, roller
10. Bearing, needle
11. Thrust washer
12. U-joint
13. Capscrew
14. Washer, lock
15. Steering gear
16. Pin, cotter
17. Nut
18. Nut
19. Washer, lock
20. Pitman arm
21. Nut
22. Ball joint
23. Drag link
24. Nut
25. Ball joint
26. Pin, cotter
27. Nut
28. Steering arm, right
29. Nut, flange
30. Key
31. Spindle assembly
32. Seal
33. Cone, bearing
34. Cup, bearing
35. Hub assembly
36. Cup, bearing
37. Cone, bearing
38. Thrust washer
39. Nut
40. Pin, cotter
41. Cap, hub
42. Steering arm
43. Nut, lock
44. Nut
45. Pin, cotter
46. Ball joint
47. Nut, jam
48. Tie rod
49. Nut

Figure 47. Steering Shaft, Gear, Hub, and Spindle Assemblies

19. Remove the nut (18) and lockwasher (19) attaching the pitman arm (20) to the steering gear assembly (15). Remove the arm from the gear assembly.
20. Remove the three 7/16-14 x 1 inch long capscrews (13) and lockwashers (14) holding the steering gear assembly to the frame. Carefully slide the steering gear assembly from the U-joint and remove it from the tractor.

Steering Gear Disassembly (Figures 48 and 49)

NOTE

As with any ball bearing unit, the steering gear parts must be kept free of dirt. Clean paper or towels should be spread on the work area before starting the disassembly of the steering gear.

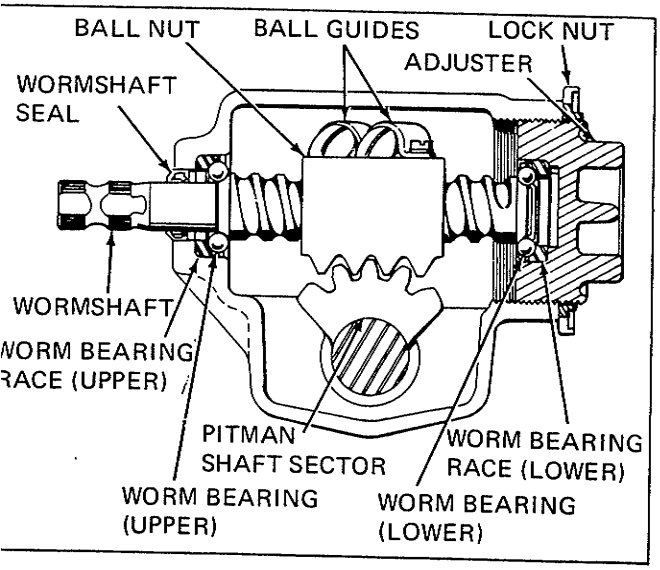


Figure 48. Steering Gear (Side View)

1. Place the steering gear in a vise. The assembly should be held by one of the mounting tabs so the worm shaft is in a horizontal position.
2. Count the number of turns made as you rotate the worm shaft so the ball nut moves from stop to stop. Then turn the shaft back exactly half way. This should place the ball nut in the center of the shaft, and the worm shaft should be in the 12 o'clock position.
3. Place a suitable container under the assembly to catch the lubricant. Remove the three self-locking bolts holding the side cover to the housing.

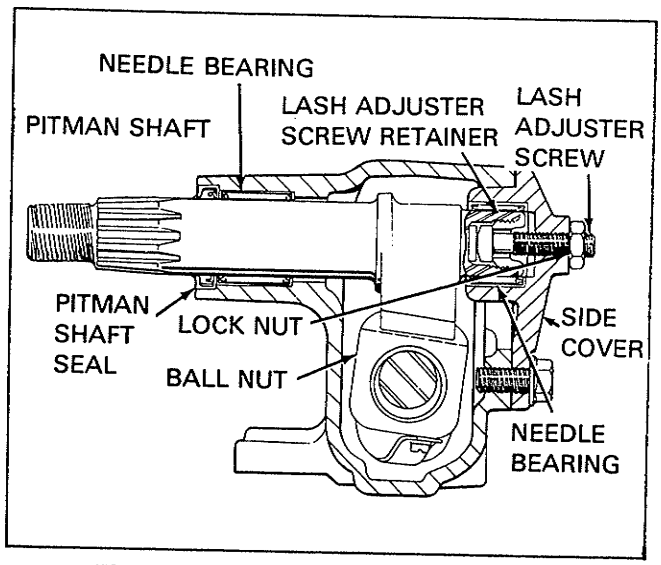


Figure 49. Steering Gear (End View)

4. Tap lightly on the end of the pitman shaft with a soft-headed mallet and pull the side cover and pitman shaft assembly from the gear housing (Figure 50).

NOTE

If the pitman shaft sector does not clear the opening in the housing easily, turn the worm shaft by hand until the sector will pass through the opening in the housing.

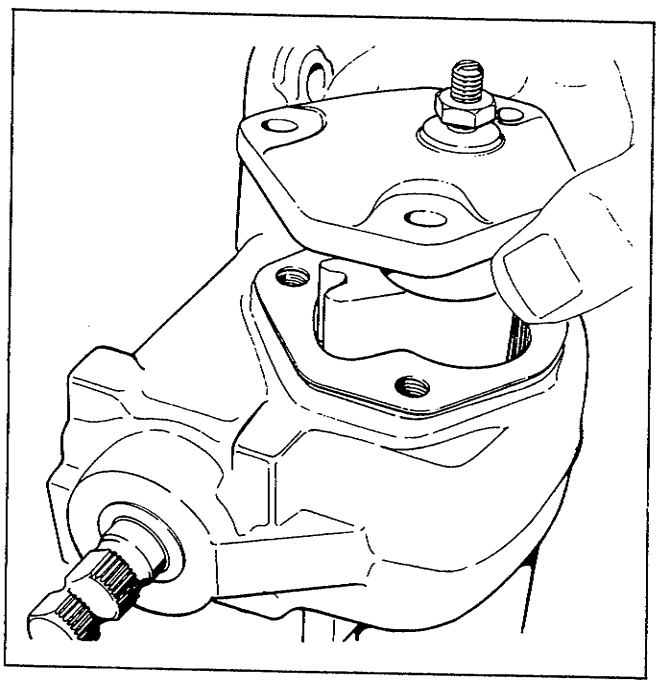


Figure 50. Removing Pitman Shaft Assembly

5. Remove the adjuster plug, which includes the lower worm shaft bearing and race, and the locknut assembly.
6. Remove the worm shaft and ball nut assembly from the gear housing (Figure 51).

CAUTION

Use care that the ball nut does not rotate down to either end of the worm shaft. The ends of the ball guides will be damaged if the nut is allowed to rotate until it is stopped at the end of the worm shaft.

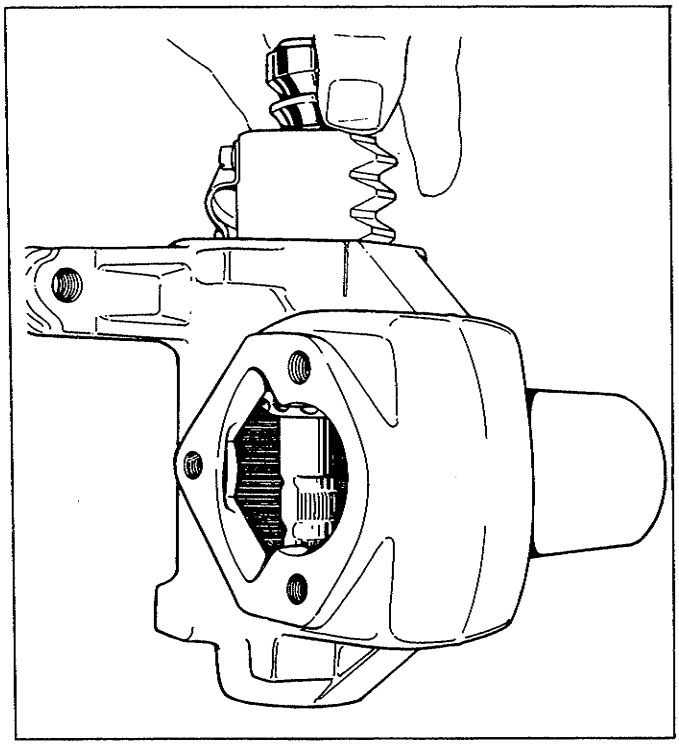


Figure 51. Removing Worm Shaft and Ball Nut

7. Remove the upper bearing from the worm shaft.
8. Use a suitable size screwdriver to pry the lower bearing retainer from the adjuster plug housing and remove the bearing (Figure 52). Remove the locknut from the adjuster plug.
9. Remove the locknut from the lash adjuster screw in the side cover. Remove the side cover from the pitman shaft-lash adjuster assembly by turning the lash adjuster screw clockwise.

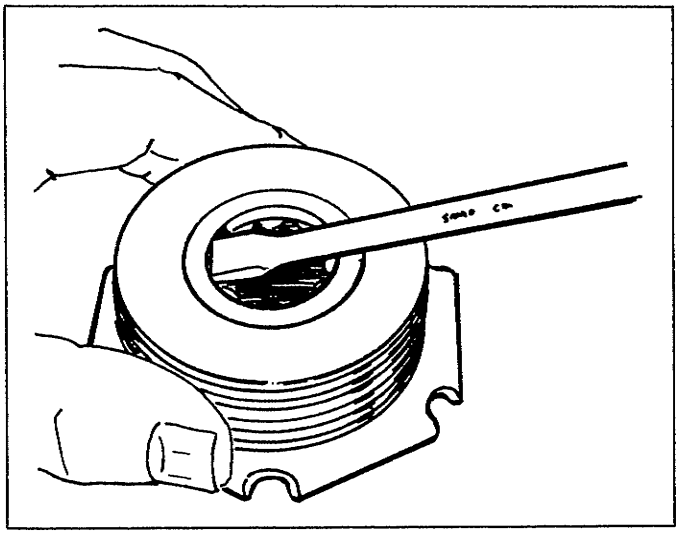


Figure 52. Removing Lower Bearing Retainer

NOTE

Do not remove the lash adjuster screw from the pitman shaft. If replacement is required, the entire pitman shaft and lash adjuster must be serviced as a unit.

10. Remove and discard both the pitman shaft and worm shaft seals.

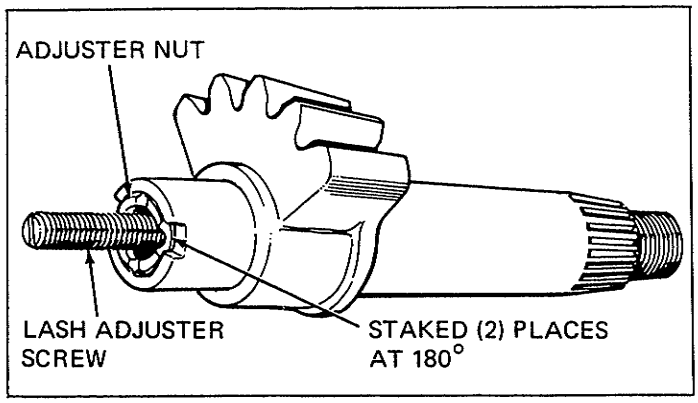


Figure 53. Pitman Shaft and Lash Adjuster

Steering Gear Inspection

Wash all parts with cleaning solvent and dry thoroughly with air. Inspect the bearings and bearing races with a magnifying glass for signs of indentation. Also check for any signs of chipping or breakdowns of the surface. Any parts that show signs of damage should be replaced.

Inspect the pitman shaft needle bearings in the side cover and housing. If the side cover bearing shows signs of wear and is unsatisfactory in operation, the entire side cover and bearing should be replaced as an assembly. If the housing pitman shaft needle bearing needs replacement, proceed as described in Steering Gear Repairs.

Check the steering gear worm shaft assembly for any damage and replace if necessary. Do not attempt to repair the worm shaft by welding or straightening.

Steering Gear Repairs

1. Pitman Shaft and Lash Adjuster Screw Replacement

   The lash adjuster screw is held in place in the pitman shaft by the adjuster nut. This nut is staked in two places at 180 degrees, which prevents its removal. If the lash adjuster screw is damaged, the entire pitman shaft and lash adjuster must be replaced as a unit.

2. Pitman Shaft and/or Worm Shaft Seal Replacement

   The double lipped pitman shaft and worm shaft seals should be replaced each time a defective seal is apparent or whenever the steering gear is disassembled.

   If the seals were not removed during disassembly, pry out the old seals using a suitable size screwdriver.

NOTE

Before installing new seals, check the condition of the pitman shaft needle bearing and the upper worm shaft bearing race.

A suitable size socket may be used to install new seals by pressing on the outer diameter of the seal.

NOTE

Care should be taken to insure that new seals are not assembled in a cocked position.

3. Pitman Shaft Needle Bearing Replacement

   Use a bearing removal tool with a handle to reach through the side cover opening and press the needle bearing from the housing (Figure 54).

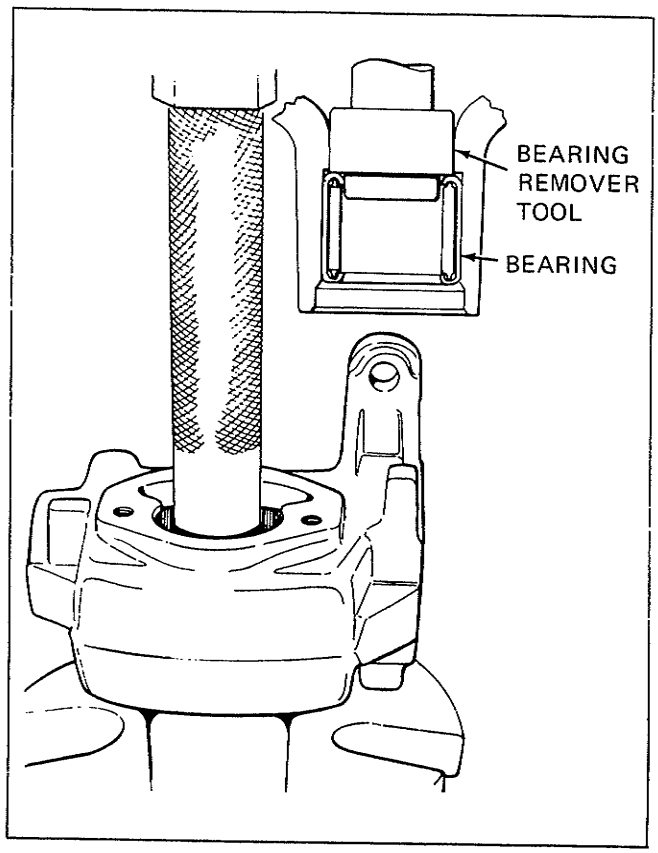


Figure 54. Removing Pitman Shaft Needle Bearing

Press the new bearing into position using a bearing installer with a handle (Figure 55).

NOTE

Press against the end of the bearing that contains the bearing manufacturer's identification. The bearing should be fully installed when the tool has bottomed on the housing.

4. Side Cover Needle Bearing Replacement

   The entire side cover assembly including the needle bearing is serviced as a unit, and it should be replaced whenever it is necessary to replace the bearing.

5. Worm Shaft Bearing Race Replacement

   The lower bearing race and adjuster plug are serviced as a unit, and they should be replaced whenever the bearing race must be replaced.

   The upper bearing race can be driven out of the housing using a drift or punch.

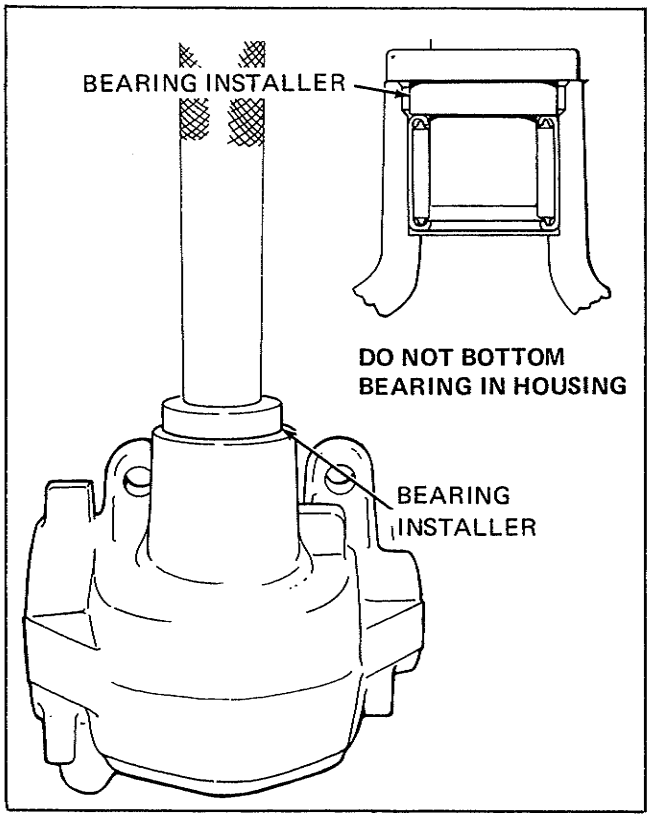


Figure 55. Installing Pitman Shaft Needle Bearing

Press the new bearing race into position using a race installer with a handle (Figure 56).

NOTE

If a socket or similar tool is used in place of a race installer tool, use extreme care to prevent damaging the bearing surface of the race. Inspect the race for nicks or scratches before proceeding with gear assembly. Replace the race if necessary.

6. Ball Nut Assembly Servicing

NOTE

As a rule, disassembly of the ball bearing nut will not be necessary if it is perfectly free with no indication of binding or tightness when rotated on the worm. However, if there is any indication of binding or tightness, the unit should be disassembled, cleaned, and inspected as follows:

a. Remove the screws and clamp retaining the ball guides in the nut. Draw the guides out of the nut.

b. Place a clean container under the nut, and turn the nut upside down. Rotate the worm shaft back and forth until all the balls have dropped out of the nut. When all 48 balls are removed, the nut can be removed from the shaft.

c. Wash all the parts with cleaning solvent, and dry them thoroughly with air. Use a magnifying glass to inspect the shaft and nut grooves, and tne surface of all the balls for signs of indentation. Check the ball guides for damage at the ends where they deflect or pick up the balls from the helical path.

NOTE

The worm shaft and ball nut are serviced as a unit. If either show signs of damage, the two must be replaced. If damage is detected on any of the balls or ball guides, the entire steering gear assembly must be replaced.

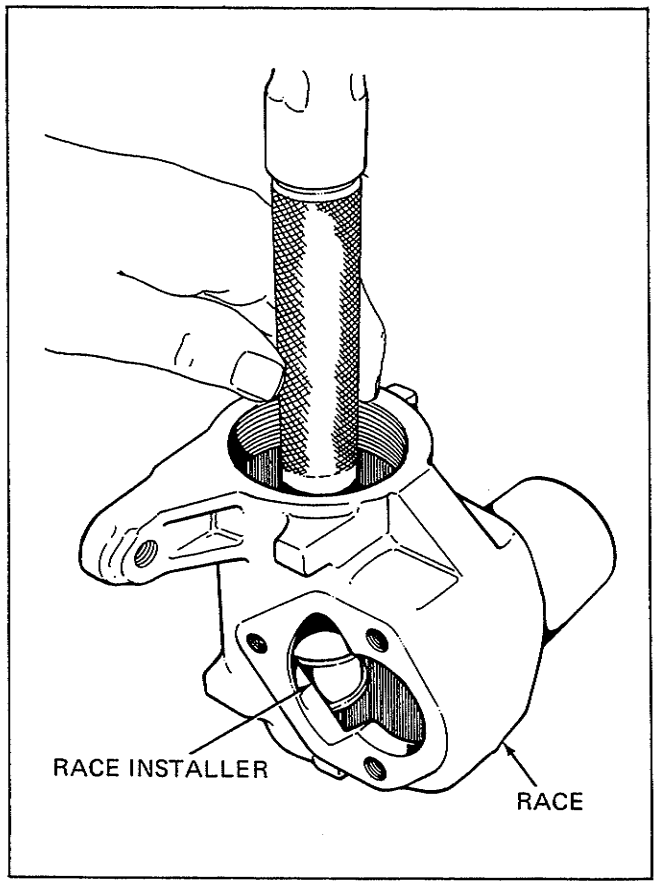


Figure 56. Installing Worm Shaft Upper Bearing Race

d. If the components in the ball nut assembly appear free from defects, fill the ball circuit as follows.

Place the worm shaft flat and slide the nut over the shaft with ball guide holes up. Align the grooves in the shaft and nut by sighting through the ball guide holes.

Place two ball guide halves together and insert them into the upper circuit in the ball nut. Place the remaining two guides together and insert them into the lower circuit.

Count 24 balls into a suitable container. This is the proper number of balls for one circuit.

Load the balls into one of the guide holes while turning the worm shaft gradually away from the hole (Figure 57). When all the balls have been installed, the circuit is complete.

Fill the remaining ball circuit in the same manner as described above.

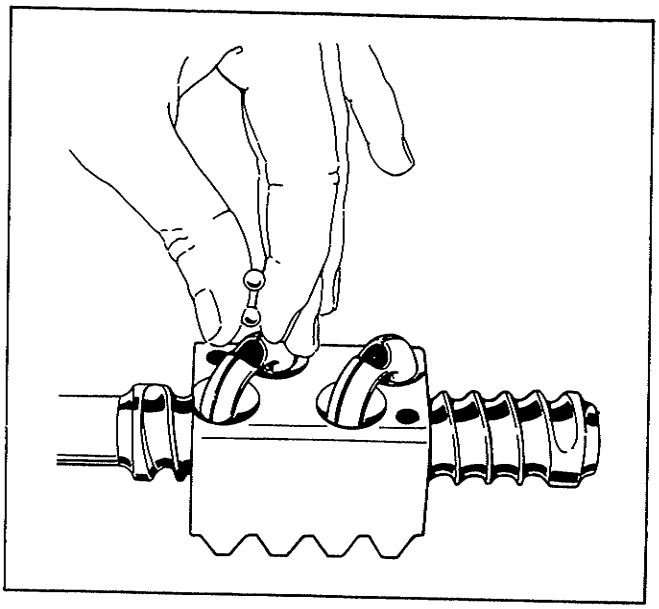


Figure 57. Filling Ball Circuits

e. Assemble the ball guide clamp to the ball nut and tighten the mounting screws.

f. Check the assembly by rotating the nut on the worm to see that it moves freely. Do not rotate the nut to the end of the shaft to prevent damage to the ball guides. If there is any trouble in the motion of the nut on the shaft, some slight damage to the ends of the ball guides or other gear components may have been overlooked.

Steering Gear Assembly (Figure 58)

NOTE

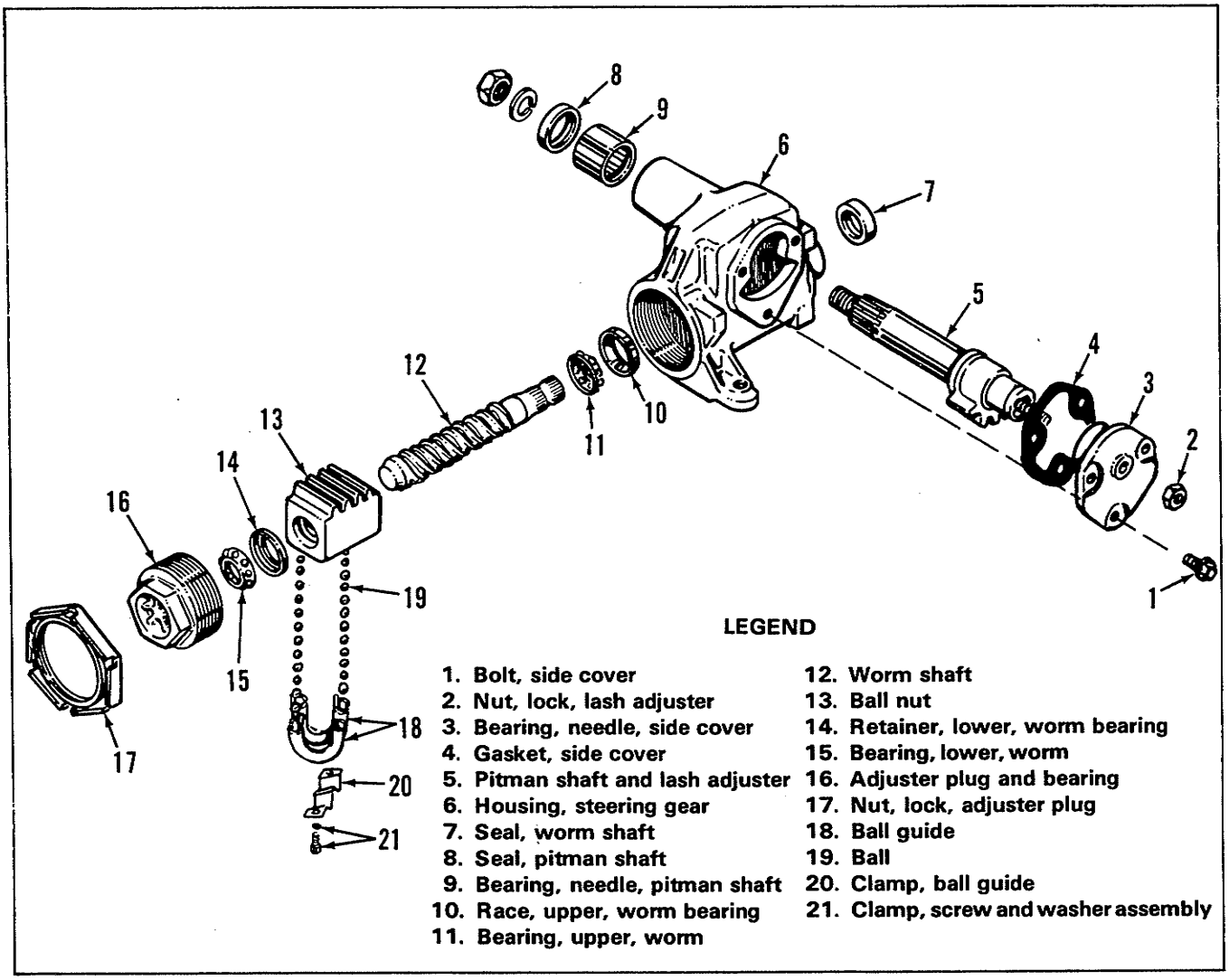
After a major service overhaul, general purpose automotive grease meeting SAE standards should be applied to the pitman shaft and bearings, the worm shaft and bearings, and the ball nut teeth.

1. Install the pitman shaft and worm shaft seals (8 and 7), the pitman shaft needle bearing (9), and the upper worm shaft bearing race (10) in the steering gear housing. Install the ball nut (13) on the worm shaft (12). Follow the procedures outlined in Steering Gear Repairs.
2. Place the steering gear in a vise. The assembly should be held by one of the mounting tabs so the worm shaft is in a horizontal position and the side cover is in an upper position.
3. Install the upper bearing (11) on the worm shaft. Insert the worm shaft and nut assembly into the gear housing feeding the end of the shaft through the upper bearing race and seal.
4. Place the lower bearing (15) in the adjuster race and press the stamped retainer (14) into place with a suitable socket.
5. Install the adjuster (16) and locknut (17) into the lower end of the gear housing. Be careful to guide the end of the worm shaft into the lower bearing (15). Tighten the adjuster plug until nearly all end-play has been removed from the worm shaft.
6. Lubricate the steering gear with 9 oz. of general purpose automotive grease meeting SAE standards. Rotate the worm shaft until the ball nut is at the end of its travel. Then pack as much new lubricant into the housing as possible without losing it out the pitman shaft opening. Rotate the worm shaft until the ball nut is at the other end of its travel, and pack as much lubricant into the opposite end of the gear housing.
7. Turn the shaft so the ball nut is in the center position. This is to make sure that the pitman shaft sector and ball nut will engage properly.

8. Insert the pitman shaft, without the side cover (3), into the housing so the center tooth at the sector enters the center tooth hole of the ball nut.
9. Place a new side cover gasket (4) on the housing and install the side cover on the pitman shaft. Use a screwdriver to turn the lash adjuster screw counterclockwise until the screw stops; then back the screw off one-half turn. Install and tighten a new locknut on the adjuster screw.
10. Install and torque the side cover bolts to specifications.

NOTE

If new side cover bolts are used at reassembly, be sure to use the specified bolts which are self-locking.



LEGEND

1. Bolt, side cover
2. Nut, lock, lash adjuster
3. Bearing, needle, side cover
4. Gasket, side cover
5. Pitman shaft and lash adjuster
6. Housing, steering gear
7. Seal, worm shaft
8. Seal, pitman shaft
9. Bearing, needle, pitman shaft
10. Race, upper, worm bearing
11. Bearing, upper, worm
12. Worm shaft
13. Ball nut
14. Retainer, lower, worm bearing
15. Bearing, lower, worm
16. Adjuster plug and bearing
17. Nut, lock, adjuster plug
18. Ball guide
19. Ball
20. Clamp, ball guide
21. Clamp, screw and washer assembly

Figure 58. Steering Gear Assembly

Steering Gear Bench Adjustment (Figures 48 and 49)

1. Tighten the adjuster plug until all end-play has been removed and then loosen one-quarter turn.
2. Use an 11/16 inch 12-point socket and an inch-pound torque wrench to carefully turn the worm shaft all the way to the right then back one-half turn.
3. Tighten the adjuster plug until the proper thrust bearing preload of 3-6 inch-pounds is obtained. Tighten the adjuster plug locknut to 70-80 foot-pounds and recheck the thrust bearing preload.
4. Count the number of turns made as you rotate the worm shaft so the ball nut moves from stop to stop. Then turn the shaft back exactly half way.
5. Loosen the lash adjuster screw locknut, and turn the lash adjuster screw clockwise to remove all lash between the ball nut and sector teeth. Then tighten the locknut.
6. Use an 11/16 inch 12-point socket and an inch-pound torque wrench to observe the highest reading while the gear is turned through the center position. The highest reading should not fall outside plus/minus 45 degrees from center. Overcenter preload, with the steering gear on center, should be 3-7 foot-pounds in excess of worm load.
7. If necessary, readjust the lash adjuster screw to obtain the proper torque. Tighten the locknut to 15 foot-pounds. Again check the torque reading through the center of travel. The combined overcenter adjustment is not to exceed 10 inch-pounds without seals and 11 inch-pounds with the seals in place.
8. The steering gear should be readjusted if the worm shaft thrust bearing preload falls below 1-1/2 inch-pounds or the total overcenter adjustment falls to below 3 inch-pounds. If this occurs, readjust to the preloads described above.

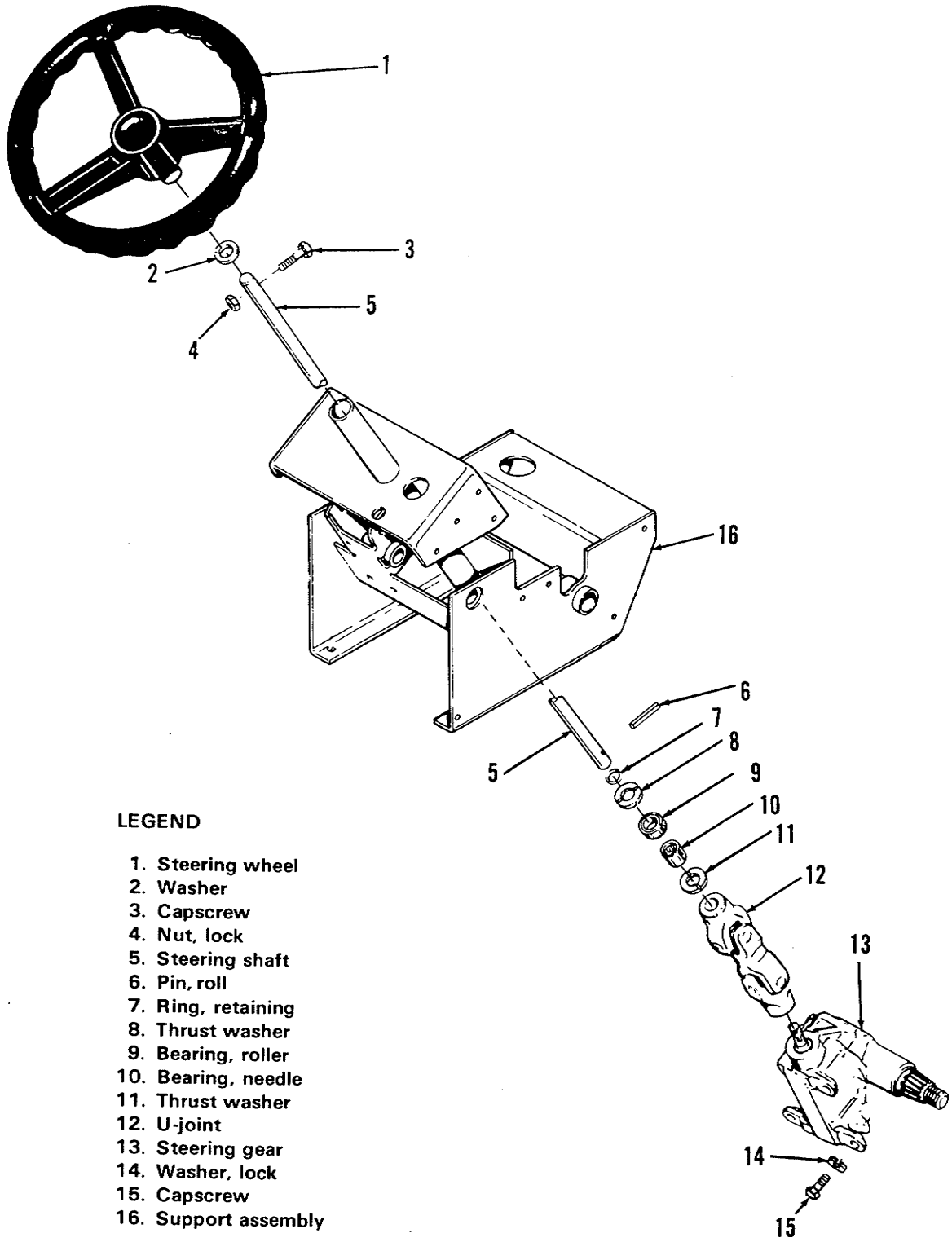
Steering Gear Installation (Figure 47)

1. Carefully insert the steering gear assembly in the U-joint (12) and secure the gear assembly to the frame with the three 7/16-14 x 1 inch long capscrews (13) and lockwashers (14). Torque the capscrews to 70-90 foot-pounds. 2.
2. Install the pitman arm (20) on the steering gear assembly (15) and secure it with the nut (18) and lockwasher (19). Torque the nut to 162-198 foot-pounds.
3. Install the same number of support assembly shims that were removed, and tilt the pivot arm and support assemblies inward toward the steering gear. Secure the support assemblies to the frame with the two 3/8-16 x 1-1/4 inch capscrews and lockwashers.
4. Install the support assembly on the tractor and secure it with the three screws and the one 5/16-18 x 3/4 inch long capscrews, washer, lock washer, and nut.
5. Secure the control valve to the support assembly using the two mounting screws.
6. Connect the hydrostatic control lever to the eyebolt with the nut and shoulder bolt, and secure the hydraulic valve linkage bellcranks to the hydraulic valve with the links.
7. Secure the clutch rod to the clutch lever assembly using the cotter pin.
8. Secure the right link rod to the right anchor, and connect the two tension springs to the left and right brakes' front link rods.
9. Connect the ignition switch to the body assembly support, and secure the body assembly support to the support assembly with the mounting screws.
10. Secure the left and right panel assembly to the body assembly support with the six mounting screws and the two speed nuts.
11. Insert the steering shaft in the shaft support tube and replace the roll pin (6).
12. Install the instrument panel assembly on the body support assembly using the six mounting screws.
13. Install the rubber washer (2) and steering wheel (1) on the steering shaft. Secure the wheel to the shaft using the 5/16-18 x 1-1/4 inch long capscrew (3) and locknut (4).
14. Install the throttle and choke cables in the clips under the hydrostatic handle and fuel tank. Attach the spring clip to the choke cable at the carburetor.
15. Install the two V-belts on the engine pulley.

16. Install the PTO drive unit and the main drive shaft. Refer to PTO Drive Unit Installation and Drive Shaft Installation for installation procedures.
17. Loosely install one capscrew and metal washer on the right side of the oil cooler. On the left side, place one rubber washer above the oil cooler and the other below it and loosely attach with the remaining capscrew and metal washer. Carefully push the oil cooler down so it is firmly seated and tighten both capscrews.
18. Install the fuel tank. Refer to Fuel Tank and Fuel Gauge Removal, Inspection, and Installation for installation procedures.
19. Adjust the belt stop assembly and the clutch belt tension and clutch free travel. Refer to Clutch Pedal Free Travel Adjustment and Clutch Belt Tension under General Information.
20. Install the bottom cover and left and upper engine shrouds.
21. Connect the negative battery cable.

Steering Shaft Removal, Inspection, and Installation

1. Remove the steering shaft (Figure 59).
   a. Remove the steering wheel and its rubber washer (2) by removing the 5/16-18 x 1-1/4 inch long capscrew (3) and locknut (4) securing them to the steering shaft.
   b. Remove the fuel tank. Refer to Fuel Tank and Fuel Gauge Removal, Inspection, and Installation for installation procedures.
   c. Remove the six screws attaching the instrument panel assembly to the body assembly support. Carefully lift the panel up and over the steering shaft using caution not to disconnect or break the instrument wire connections.
   d. Remove the roll pin (6) connecting the steering shaft to the U-joint (12). Hold the shaft in place and remove the retaining ring (7) and thrust washers (8, 11).
   e. Pull the steering shaft up and through the shaft support tube.
   f. Use a bearing puller to remove the bearings (9 and 10) from the shaft support tube.
2. Inspect, clean, and replace the steering shaft components.
   a. Wash all the parts with cleaning solvent, and dry them thoroughly with compressed air. Do not spin bearings with compressed air.
   b. Check bearings for looseness, wear, roughness, pitting or scoring. Replace them if necessary. Refer to the Bearing Cleaning and Inspection Section.
   c. Check shaft for wear or burrs and replace if necessary.
   d. Check the roll pin for cracks or wear and replace if necessary.
3. Install the steering shaft (Figure 59).
   a. Hand pack the bearings (9, 10) with general purpose automotive grease. Press them into the shaft support tube. The needle bearing (10) should be placed in the bottom of the shaft support tube and the needle bearing (9) in the top.
   b. Carefully insert the steering shaft into the support tube. Position the thrust washer (11) on the U-joint and insert the shaft into the U-joint aligning the pin holes. Install the roll pin (6).
   c. Install the thrust washer and retaining ring.
   d. Install the fuel tank. Refer to Fuel Tank and Fuel Gauge Removal, Inspection, and Installation for installation procedures.
   e. Install the instrument panel assembly on the body assembly support using the six mounting screws.
   f. Install the rubber washer (2) and steering wheel (1) on the steering shaft. Secure the wheel to the shaft using the 5/16-18 x 1-1/4 inch long capscrew (3) and locknut (4).



LEGEND

1. Steering wheel
2. Washer
3. Capscrew
4. Nut, lock
5. Steering shaft
6. Pin, roll
7. Ring, retaining
8. Thrust washer
9. Bearing, roller
10. Bearing, needle
11. Thrust washer
12. U-joint
13. Steering gear
14. Washer, lock
15. Capscrew
16. Support assembly

Figure 59. Steering Shaft Assembly

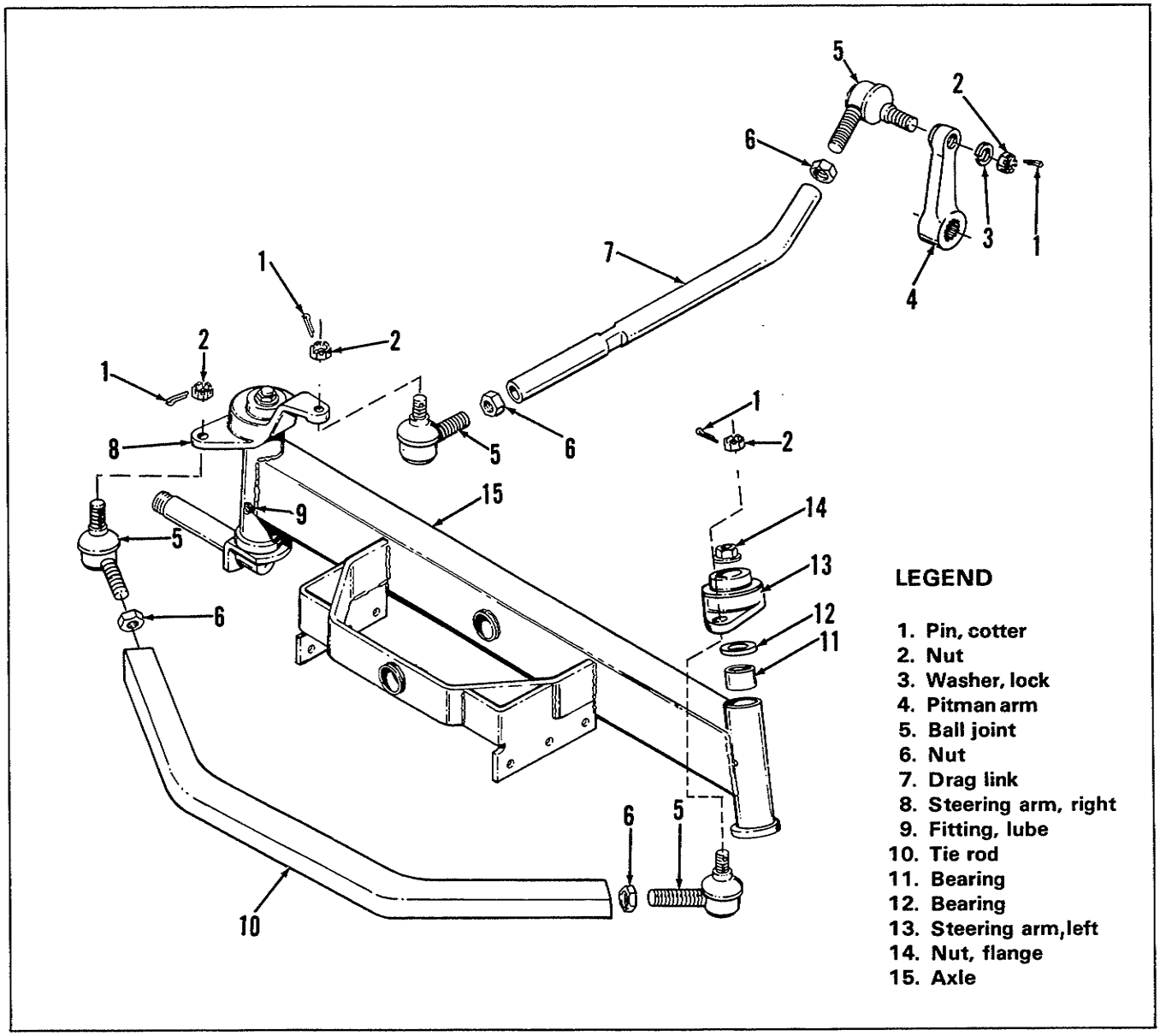


Figure 60. Drag Link and Tie Rod

Drag Link Removal, Inspection, Installation and Adjustment

1. Remove the drag link (Figure 60).

   a. Remove the cotter pins (1), slotted nuts (2) and lockwasher (3) holding the ball joints to the pitman arm (4) and right steering arm (8). Remove the drag link with ball joints from the tractor.

NOTE

The tapered bolts on the ball joints are tight fitting. Damage can be caused by hammering on top of the ball joints or on either the drag link or tie rod. The slotted nuts can be loosened from the tapered bolts by holding a large hammer on one side of the casting surrounding the bolt and hitting the other side of the casting with another hammer (Figure 61).

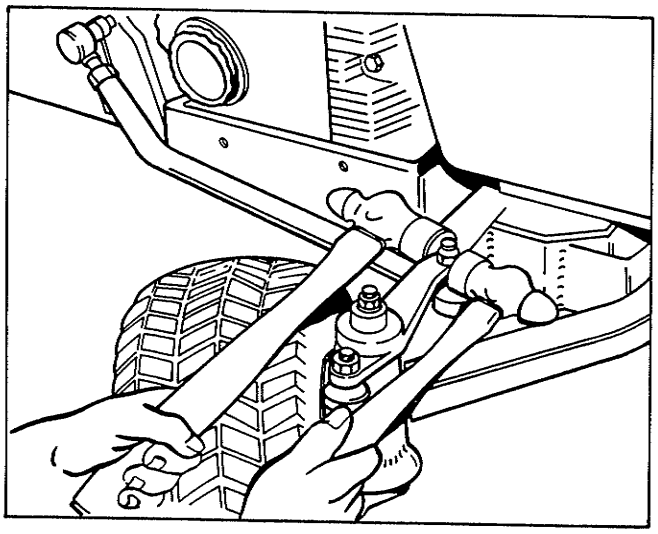


Figure 61. Ball Joint Removal

b. Loosen the ball joint jam nuts (6) and remove the ball joints from the drag link.

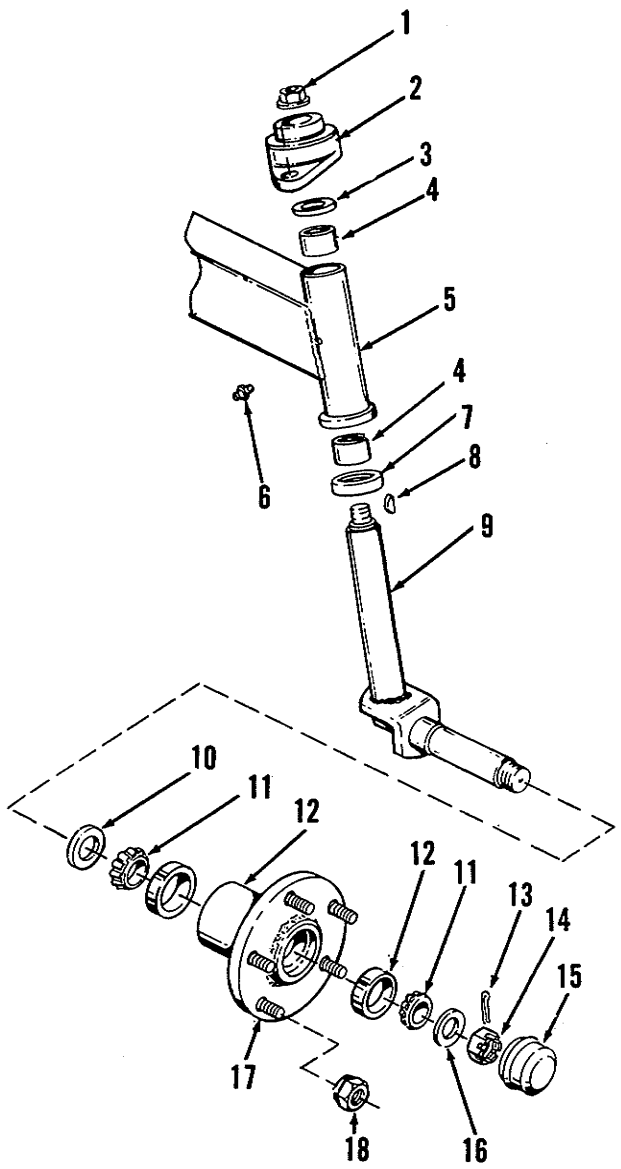
2. Inspect, clean, and replace the drag link components.
   a. Wash all the parts with cleaning solvent and dry them thouroughly.
   b. Check the ball joints for stripped threads and distortion. Replace if necessary.
   c. Inspect the drag link for unusual bends or distortion. Replace if necessary.
3. Install and adjust the drag link (Figure 60).
   a. Install the ball joints on the drag link. Do not tighten the ball joint nuts (6).
   b. Center the steering wheel between the locks and align the wheels so they point straight ahead.
   c. Secure the ball joint (5) to the right steering arm (8) with the slotted nut (2).
   d. Secure the ball joint (5) to the pitman arm (4) with the slotted nut (3), and lockwasher (3).
   e. Hold the drag link away from the tractor and tighten the ball joint nuts (6). Torque the slotted nuts (2) to 50-55 foot-pounds. Install the cotter pins (1) in the slotted nuts and bend them over.

Tie Rod Removal, Inspection, and Installation

1. Remove the tie rod (Figure 60).
   a. Remove the cotter pins (1) and slotted nuts (2) securing the steering arms (8 and 13) to the ball joints (5). Remove the tie rod with ball joints from the tractor.
   b. Loosen the ball joint jam nuts (6) and remove the ball joints (5) from the tie rod (10).
2. Inspect, clean, and replace the tie rod components.
   a. Wash all parts with cleaning solvent and dry them thouroughly.
   b. Check the ball joints for stripped threads and distortion. Replace if necessary.
   c. Inspect the tie rod for unusual bends or distortion. Replace if necessary.
3. Install the tie rod (Figure 60).
   a. Adjust toe-in to 3/8 plus/minus 1/8. Tighten the ball joints (5) on the tie rod and secure them with the jam nuts.
   b. Install the tie rod and ball joints on the steering arms (8 and 13). Secure both of the ball joints (5) with the slotted nuts (2). Torque the slotted nuts to 50-55 foot-pounds. Install the cotter pins (1) in the slotted nuts and bend them over.

Hub Removal, Inspection, and Installation

1. Remove either hub (Figure 62).
   a. Block the rear wheels. Raise the tractor front to the required height for wheel removal and place it on a suitable stand.
   b. Remove the five 7/16-20 wheel nuts to remove the front wheel.
   c. Use a pliers or soft-headed mallet to remove the dust cover (15) from the wheel hub.
   d. Remove the cotter pin (13), nut (14), washer (16), and bearing cone (11) from the spindle shaft. Note the positions of the bearing cones and bearing cups so they can be installed in their original positions.
   e. Pull the hub (17) off the spindle shaft.
   f. Use a large drift pin to push the seal (10) out of the hub and then discard the seal. Remove the bearing cone (11). If the bearing cups (12) must be removed from the hub, use a bearing cup puller.
2. Inspect, clean, and replace the hub components.
   a. Wash all parts with cleaning solvent and dry them thoroughly.



LEGEND

1. Nut, flange	10. Seal
2. Steering arm, left and right	11. Cone, bearing
3. Bearing	12. Cup, bearing
4. Bearing	13. Pin, cotter
5. Axle	14. Nut
6. Fitting, lube	15. Cap, hub
7. Bearing	16. Washer
8. Key	17. Hub
9. Spindle assembly	18. Nut

Figure 62. Hub and Spindle

NOTE

Wheel lug bolts can be replaced by pressing old stud out, and pressing new stud in (part no. 1663805).

b. Check bearings for looseness, wear, roughness, pitting or scoring. Replace if necessary. Refer to the Bearing Cleaning and Inspection Section under General Information.

c. Inspect the hub for cracks or damage. Replace it if necessary.

3. Install either hub (Figure 62).

a. If the bearing cups (12) were removed, press them into their positions in the hub.

b. Use the palm of your hand to force a good quality wheel bearing grease into the bearing cones. Apply grease to the spindle shaft.

c. Seat the bearing cone (11) in the bearing cup (12) and press a new seal (10) in place on the bearing cone.

d. Slide the hub (17) on the spindle shaft (9) being careful not to damage the seal. Install the greased bearing cine (11), thrust washer (16), and slotted nut (14) on the spindle shaft.

e. Alternately tighten the slotted nut and spin the hub until a drag is felt on the hub. This should produce a rolling torque of 1 foot-pound. There should be no play on the wheel.

f. Install the cotter pin (13) in the nearest slot available and bend it over.

g. Install the dust cover (15).

h. Position the wheel on the hub and secure it with the five 7/16-20 wheel nuts. Torque the nuts to 40-50 foot-pounds.

i. Lower the tractor from the stands and remove the rear wheel blocks.

Spindle Removal, Inspection, and Installation

1. Remove either spindle (Figure 62).

a. Remove the hub.

b. Remove the cotter pin and slotted nut holding the ball joint to the steering arm (2). If the right spindle is being removed, remove the cotter pin, slotted nut and lockwasher securing the ball joint to the other side of the steering arm.

c. Remove the locknut (1) from the top of the spindle and use a bearing puller to carefully separate the steering arm from the spindle. Remove the thrust washer (3) and the key (8).

d. Slide the spindle from the axle tube.

2. Inspect, clean, and replace the spindle components.

a. Wash all parts with cleaning solvent and dry them thoroughly.

b. Check the spindle for stripped threads and distortion. Replace it if necessary.

c. Examine the keys for bends, breaks or unusual damage. Replace it if necessary.

3. Install either spindle (Figure 62).

a. Apply grease to the spindle column and insert it in the front axle tube.

b. Position the key (8) on the spindle and install the steering arm. Carefully align the slot, key, and thrust washer.

c. Secure the steering arm to the spindle with the locknut. Torque the locknut to 70 foot-pounds. On heavy duty axles, torque the locknut to 125-135 foot-pounds. If the right spindle was removed, secure the drag link ball joint to the steering arm with the slotted nut and lockwasher. Secure the tie rod ball joint to the steering arm with the slotted nut. Torque all ball joints to 50-55 foot-pounds. Install the cotter pins in the slotted nuts and bend over.

d. Install the hub.

e. Fill the spindle tube through its grease fitting with general purpose automotive grease.

Front Axle Removal, Inspection, and Installation

1. Remove the front axle (Figure 63).

a. Block the rear wheels. Raise the tractor front to the required height for wheel removal and place a suitable stand under the frame.

b. Remove both wheels, hubs, spindles, the draglink, and the tie rod.

c. Remove the clevis (3) by removing the bolt, lockwasher, flat washer and nut.

Remove the clevis (3) on the 9020 tractor with a Manufacturing No. 1690230 or 1690283 by removing the bolt (1), lockwasher (2) and nut (5). Remove the reach bushing (4).

d. Disconnect the front axle from the frame by removing the capscrew (6), thrust washers (7 and 8), lockwasher (13), and nut (14). Remove the axle.

e. Remove the grease fittings (15) from the axle assembly only if they must be replaced.

f. If they must be replaced, use a soft-headed mallet to tap the axle bushings (9 and 10) from the axle assembly. Separate the bushings from the axle spacer (11).

2. Inspect, clean, and replace the axle components.

a. Wash all parts with cleaning solvent and dry them thoroughly.

b. Inspect bushings, reach bearing, and spacers for unusual wear or grooves. Replace them if necessary.

c. Inspect the axle assembly for cracks, damage, or distortion. Replace it if necessary.

3. Install the front axle (Figure 63).

a. Insert the spacer (11) in the front axle assembly, and press the two bushings (9 and 10) over either side of the spacer until they are flush with the axle channel. Do not press either bushing beyond the axle channel surface. This will prevent the grease fitting from being inserted entirely and lubricant will be blocked.

b. Secure the axle assembly to the frame with the capscrew (6), thrust washers (7 and 8), lockwasher (13) and nut (14). Torque the capscrew to 150 foot-pounds.

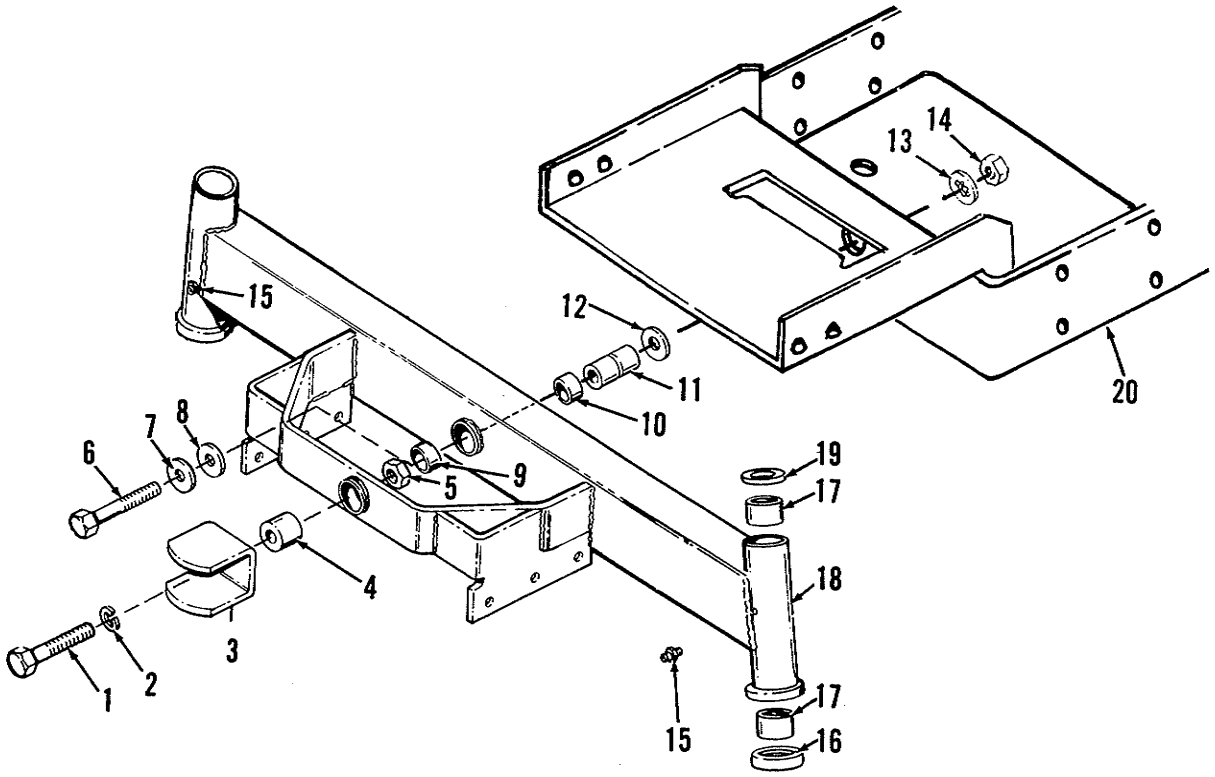
c. Press the reach bearing into the axle assembly.

d. Secure the clevis using the bolt, lockwasher, flat washer and nut. Torque the bolt to 150 foot-pounds.

On the 9020 tractor with a Manufacturing No. 1690230 or 1690283, install the clevis using the bolt, lockwasher, and nut. Torque the bolt to 190-200 foot-pounds.

e. Install the tie rod, drag link, spindles, hubs and both wheels.

f. Lower the tractor from the stands and remove the rear wheel blocks.



LEGEND

1. Capscrew	6. Capscrew	11. Spacer	16. Bearing
2. Washer, lock	7. Thrust washer	12. Thrust washer	17. Bearing
3. Clevis	8. Thrust washer	13. Washer, lock	18. Axle
4. Bushing	9. Bearing	14. Nut	19. Bearing
5. Nut	10. Bearing	15. Fitting, lube	20. Frame

Figure 63. Front Axle Assembly

Tractor Repair (Continued)

POWER LIFT SYSTEM

Description (Figure 64)

The power lift system consists of a control lever and valve, the oil cooler, the hydraulic lift cylinder, and the associated hoses, tubes and linkage. The hydrostatic transmission charge pump, and the charge and implement relief valves provide regulated and pressurized oil for the system.

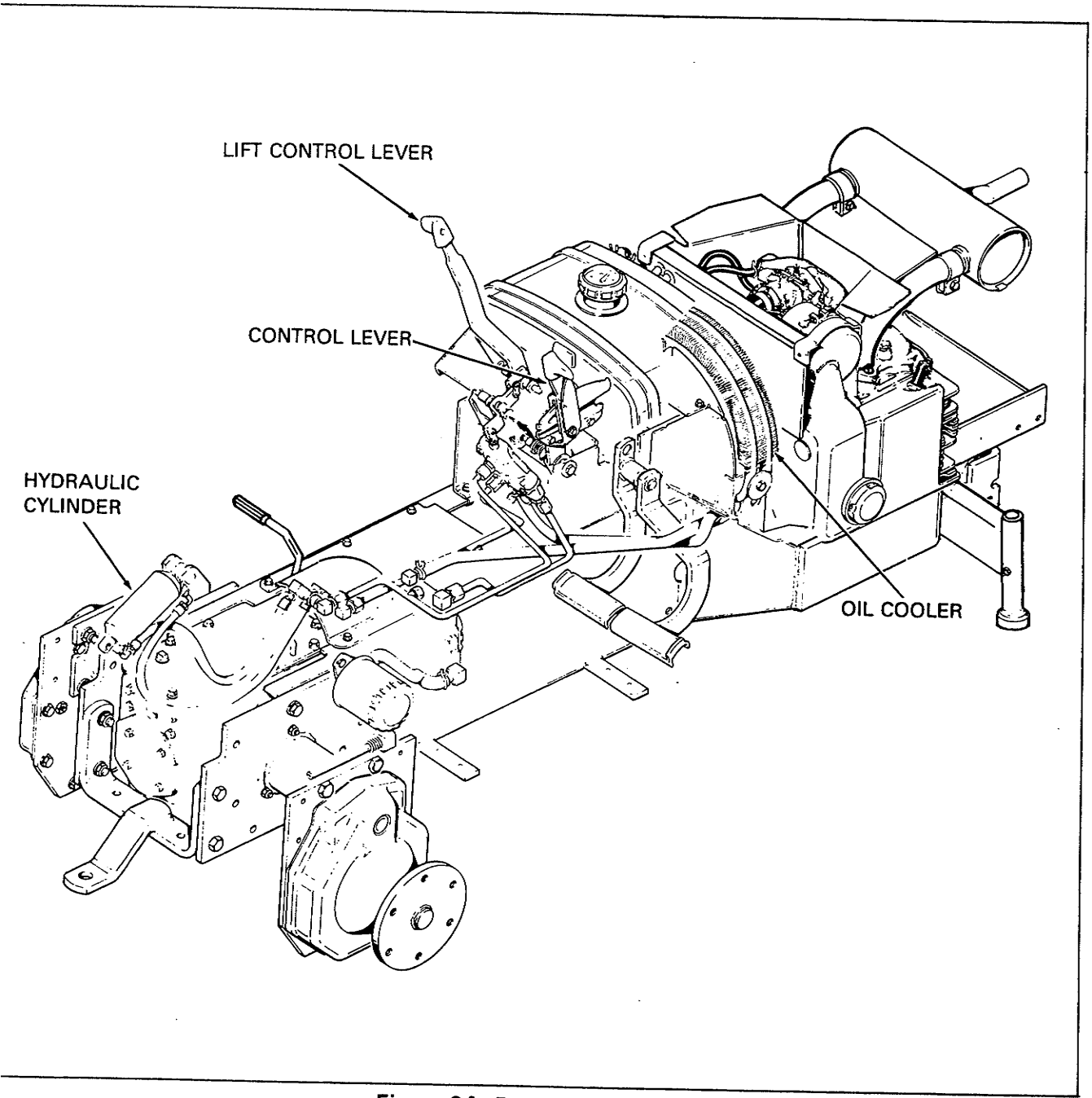


Figure 64. Power Lift System

Function (Figure 65)

When the clutch is engaged, the hydrostatic transmission input shaft rotates causing the pump cylinder block and charge pump to also rotate. The charge pump rotation draws oil from the transmission case, through the filter, and pumps it to the hydrostatic implement and charge relief valves.

The by-pass oil from the charge relief valve flows to the hydrostatic unit. When the charge relief valve breaks at 75-150 psi, oil flows at 75-150 psi to the control valve. This pressure depends upon the charge and implement relief valve settings. The hydrostatic implement relief valve breaks at 550-700 psi. This oil also flows to the control valve. The control valve routes the pressurized oil to the hydraulic lift cylinder and to the hydrostatic unit through the oil cooler.

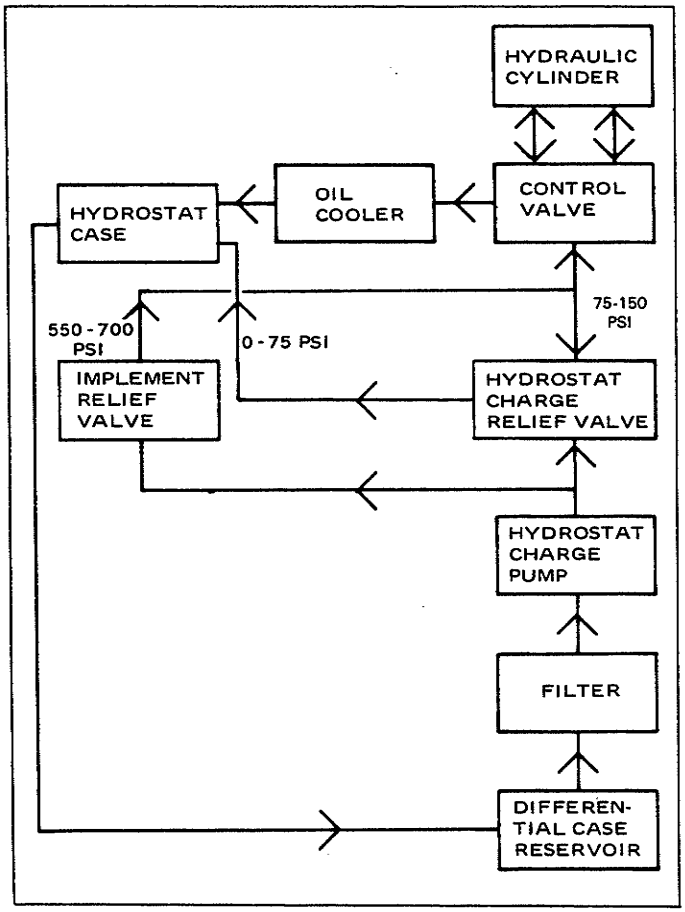


Figure 65. Power Lift Hydraulic Flow Diagram

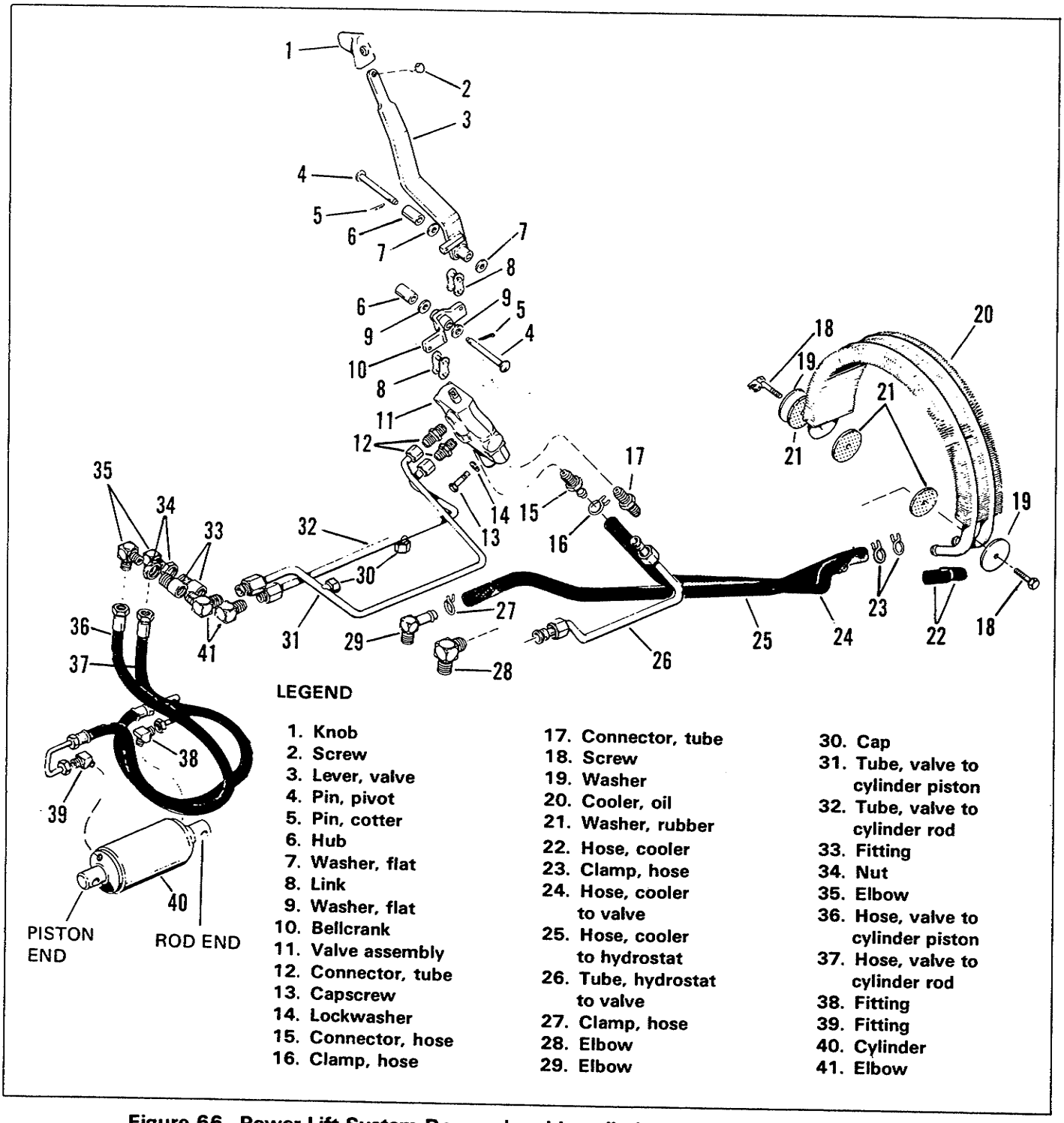
The lift control lever moves the control valve spool to the FLOAT, LOWER, HOLD, or RAISE positions. The control valve spool routes the pressurized oil to the hydraulic cylinder piston and/or rod ends.

In the HOLD and FLOAT positions, all valve passage ways are open. When the control lever is placed in the RAISE position, oil is routed to the piston end of the cylinder. This extends the cylinder rod, pivots a lift arm, and raises the implement. If the control lever is moved to the LOWER position, oil is directed to the rod end of the cylinder. This retracts the cylinder rod, pivots a lift arm, and lowers the implement.

The hydraulic cylinder is usually connected to the rocker shaft or lever assembly which raises center mounted attachments. If the tractor is equipped with the 3-point hitch (optional factory or field installed), the hydraulic control lever can also control rear attachments mounted on the 3-point hitch. If a front hydraulic kit is installed, the hydraulic cylinder can also be used to control front mounted attachments.

Hydraulic Control Valve Removal and Installation

1. Remove the hydraulic control valve (Figures 66 and 67)
   a. Be sure the lift control lever is in the FLOAT position and the ignition switch is in the OFF position.
   b. Disconnect the negative battery cable. Remove the choke cable from the clip at the right side of the body assembly support.
   c. Remove the steering wheel and its rubber washer by removing the 5/16-18 x 1-1/4 inch long capscrew and locknut securing them to the steering shaft.
   d. Remove the six screws and two speed nuts holding the left and right panel assembly to the body assembly support, and remove the panel assemblies.
   e. Remove the six screws attaching the panel assembly to the body assembly support. Carefully lift the panel up and over the steering shaft using caution not to disconnect or break the instrument wire connections.
   f. Remove the remaining screws holding the body assembly support to the support assembly. Disconnect the ignition switch from the body assembly support, and remove the body assembly support from the tractor.



LEGEND

1. Knob
2. Screw
3. Lever, valve
4. Pin, pivot
5. Pin, cotter
6. Hub
7. Washer, flat
8. Link
9. Washer, flat
10. Bellcrank
11. Valve assembly
12. Connector, tube
13. Capscrew
14. Lockwasher
15. Connector, hose
16. Clamp, hose
17. Connector, tube
18. Screw
19. Washer
20. Cooler, oil
21. Washer, rubber
22. Hose, cooler
23. Clamp, hose
24. Hose, cooler to valve
25. Hose, cooler to hydrostat
26. Tube, hydrostat to valve
27. Clamp, hose
28. Elbow
29. Elbow
30. Cap
31. Tube, valve to cylinder piston
32. Tube, valve to cylinder rod
33. Fitting
34. Nut
35. Elbow
36. Hose, valve to cylinder piston
37. Hose, valve to cylinder rod
38. Fitting
39. Fitting
40. Cylinder
41. Elbow

Figure 66. Power Lift System Removal and Installation (4040, 4041, Pow'r Max)

g. Check for proper operation of the control lever and linkage. The lever should return to the HOLD position when released from the RAISE or LOWER positions. Disassemble the lever assembly as required for repairs.

h. Remove the connecting links (8) from the control valve (11) and bell cranks (10).

i. Tag the valve tubing to aid in correct installation. Place a suitable container under the valve and cylinder tubing caps (30) to catch the oil remaining in the valve and tubing. Loosen the cylinder tubing nuts to allow the oil to drain into the container. Remove the five tubes (26, 31, 32, 54, and 55) from the male connectors on the valve and allow the oil to drain into the container.

j. Loosen the hose clamp (16) and remove the hose (24) from the hose connector (15).

k. Remove the two screws (13) securing the control valve to the support assembly and remove the control valve.

l. Remove the six connectors (12, 15, and 17) from the control valve.

NOTE

For information on servicing the control valve, contact the manufacturer, Cessna Aircraft Co., Industrial Products Div., Hutchinson, Kansas. Service manuals and parts lists are available.

2. Inspect, clean and replace the hydraulic control valve assembly components.

   a. Wash the tubes, connectors, control valve, and components of the lever assembly with cleaning solvent and dry them thoroughly.

   b. Check the connectors for stripped threads, and replace if necessary.

   c. Examine the tube assemblies for bends, breaks, or cracks. Replace them if necessary.

   d. Examine the lever assembly for signs of wear or distortion. Replace any parts if necessary.

3. Install the hydraulic control valve (Figure 66 and 67).

   a. Install the six connectors (12, 15, and 17) in the control valve. Make sure the hose connector (15) is installed in the correct orifice.

   b. Secure the control valve to the frame support with the two mounting screws (13).

   c. Attach the hose (24) to the hose connector with the hose clamp. Install the tubing caps (30). Attach the valve tubing (26, 31, 32, 54, and 55) to the connectors at the valve.

   d. If the lever assembly was disassembled, assemble it. Attach the connecting links (8) to the control valve and bell cranks (10). Check for proper operation of the control valve.

   e. Connect the ignition switch to the body assembly support, and secure the body assembly support to the support assembly with the mounting screws.

   f. Install the instrument panel assembly on the body assembly support using the six mounting screws.

   g. Install the left and right panel assembly to the body assembly support using the six screws and the two speed nuts.

   h. Install the rubber washer and steering wheel on the steering shaft. Secure the wheel to the shaft using the 5/16-18 x 1-1/4 inch long capscrew and locknut.

   i. Insert the choke cable in the spring clip at the right side of the body assembly support.

   j. Connect the negative battery cable.

   k. Replace hydraulic system oil. Refer to transmission Fluid and Filter under General Information.

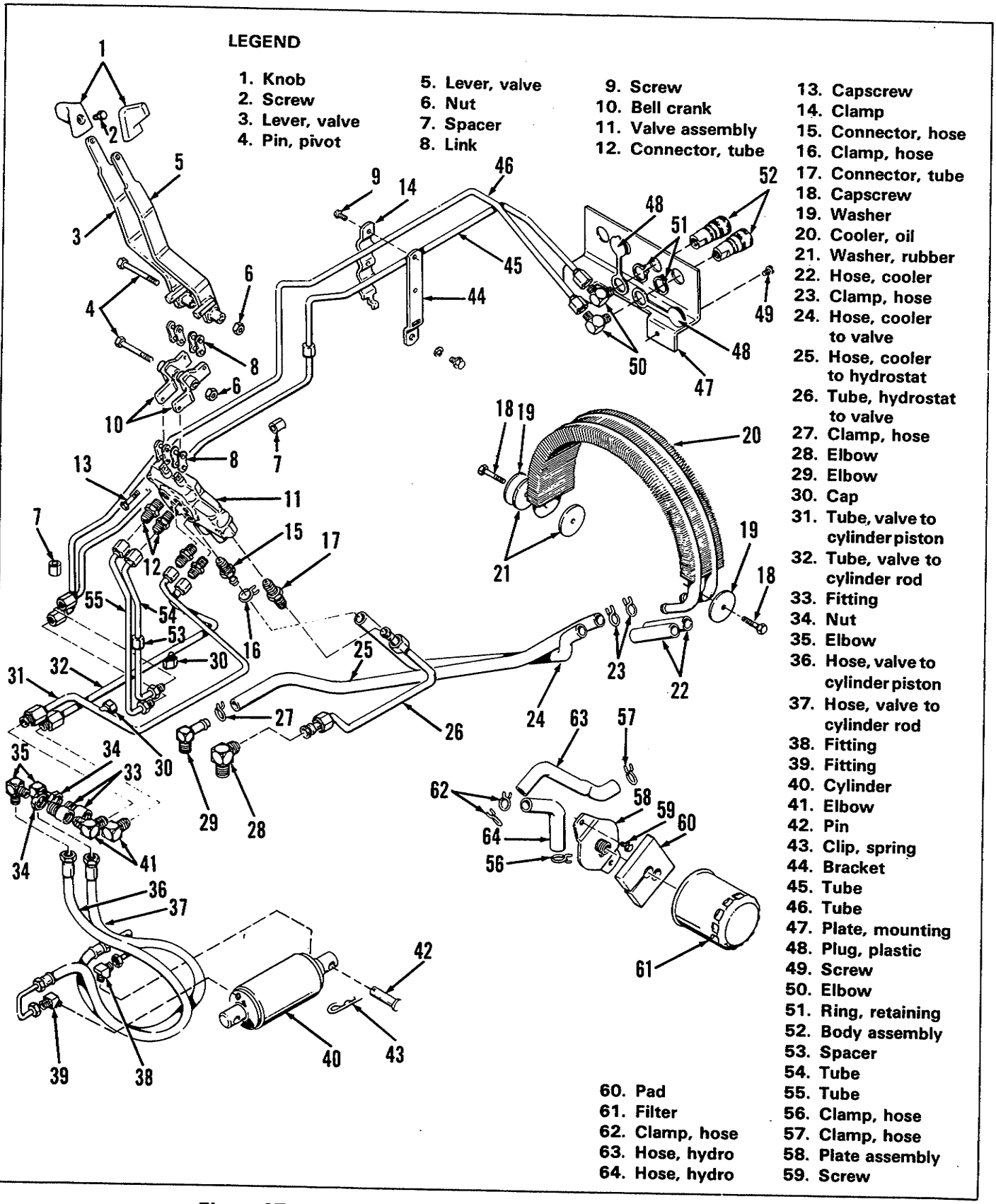


Figure 67. Power Lift System Removal and Installation (9020)

Hydraulic Cylinder Removal (Figure 68)

1. Remove the hairpin clips from the mounting pins, and remove the pins.
2. Remove the cylinder from the tractor being careful not to damage the hydraulic lines.
3. Place a suitable container under the hose fittings and loosen them. Allow the oil to drain.
4. Note the position of the hose connections. Disconnect the hose fittings and plug them. Remove the cylinder elbows if the cylinder is to be replaced.

Hydraulic Cylinder Installation (Figure 68)

1. If the hydraulic cylinder elbow connections were removed, install them.
2. Connect the hose fittings to the cylinder elbows.
3. Position the cylinder on the tractor and secure it with the pins and hairpin clips.

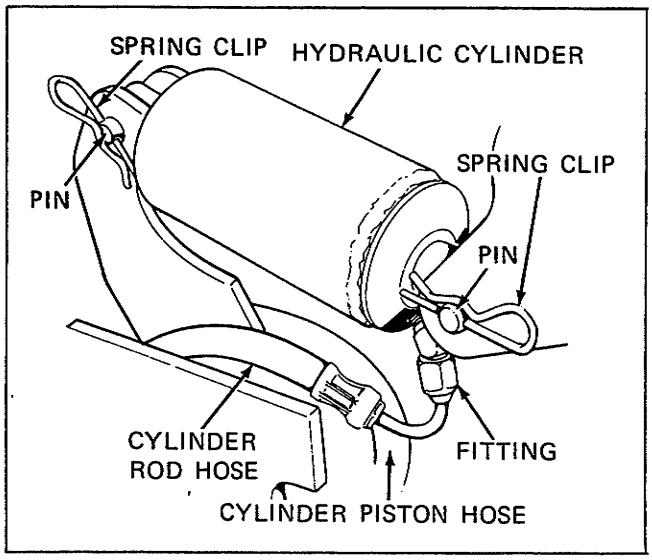


Figure 68. Hydraulic Cylinder

Oil Cooler Removal, Inspection, and Installation

1. Remove the oil cooler (Figure 66 and 67).
   a. Remove the 1/4-20 x 1-1/2 inch long capscrew (18) and two rubber washers (21) and one metal washer (19) securing the oil cooler to the left engine shroud.
   b. Remove the 1/4-20 x 1-1/2 inch long capscrew (18) and metal washer (19) and rubber washer (21) where used, securing the oil cooler to the right engine shroud.
   c. Place a suitable container under the oil cooler hose connections at the right engine shroud.
   d. Remove the hose clamps (23) holding the hoses to the oil cooler tubing. Allow the oil from the hoses and the oil cooler to drain into the container. If necessary, remove the short hoses (22) from the oil cooler tubing.
2. Inspect, clean, and repair the oil cooler.
   a. Inspect the oil cooler, and if necessary, remove any dirt, chaff or oil which may decrease the efficiency of the cooler. Dirt and chaff can be carefully brushed off, or blown off, and a non-flammable solvent can be used to remove oil.

⚠ CAUTION

Do not bend the oil cooler fins.

   b. If the cooler fins or tubing are damaged so oil flow is restricted or cooling is prevented, replace the cooler. The fins may be straightened if caution is used.
3. Install the oil cooler (Figures 66 and 67).
   a. If the short hoses (22) were removed, install them on the oil cooler tubing. Attach the hoses to the oil cooler tubing using the hose clamps (23). The hoses must be positioned on the tubing so the clamps are installed behind the raised portion of the tubing.
   b. Secure the oil cooler to the right engine shroud with the 1/4-20 x 1-1/2 inch long capscrew (18) and metal washer (19) and rubber washer (21) where used, and to the left engine shroud with the 1/4-20 x 1-1/2 inch long capscrew (18), metal washer (19), and two rubber washers (21).

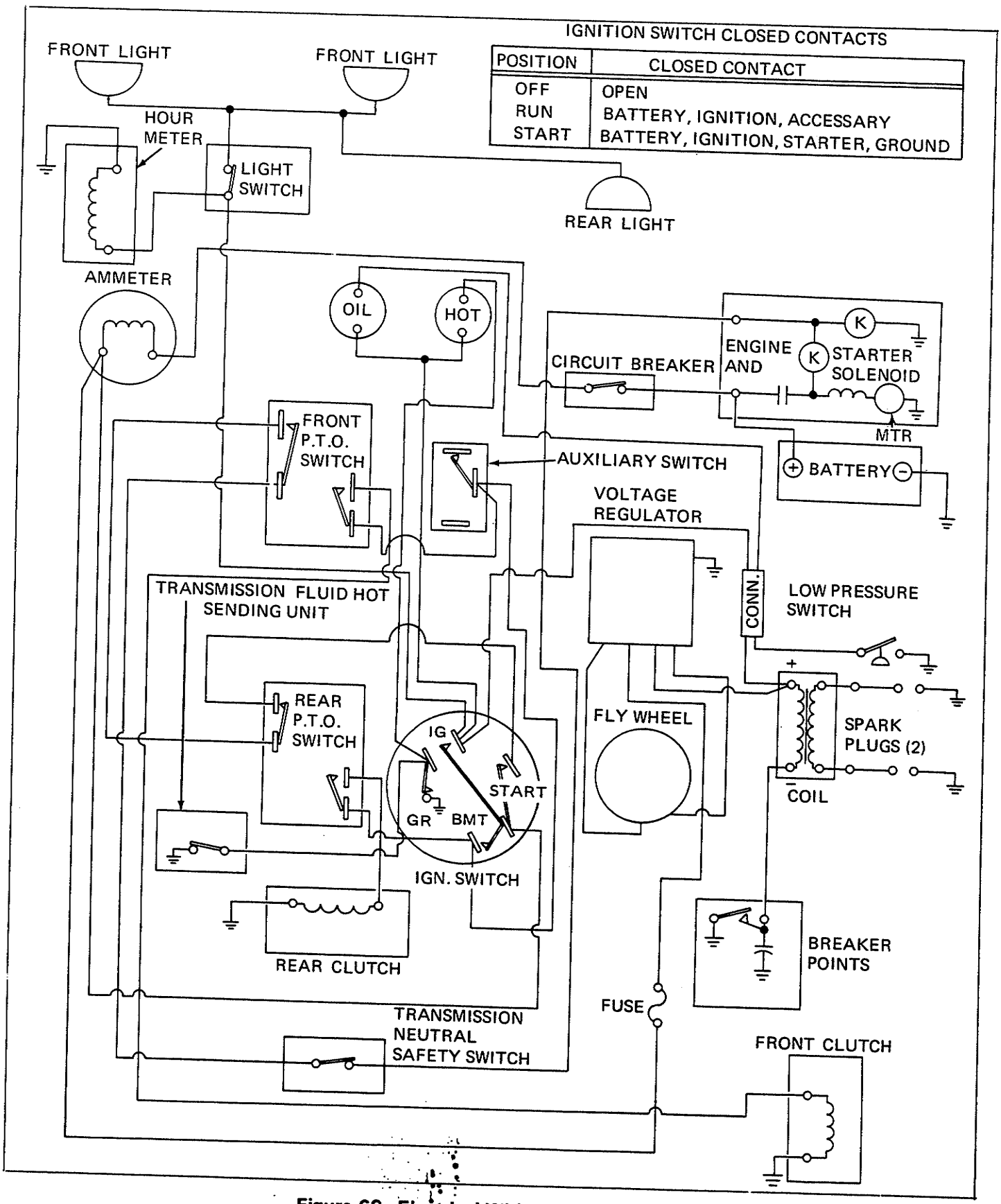


Figure 69. Electrical Wiring Diagram (4040)

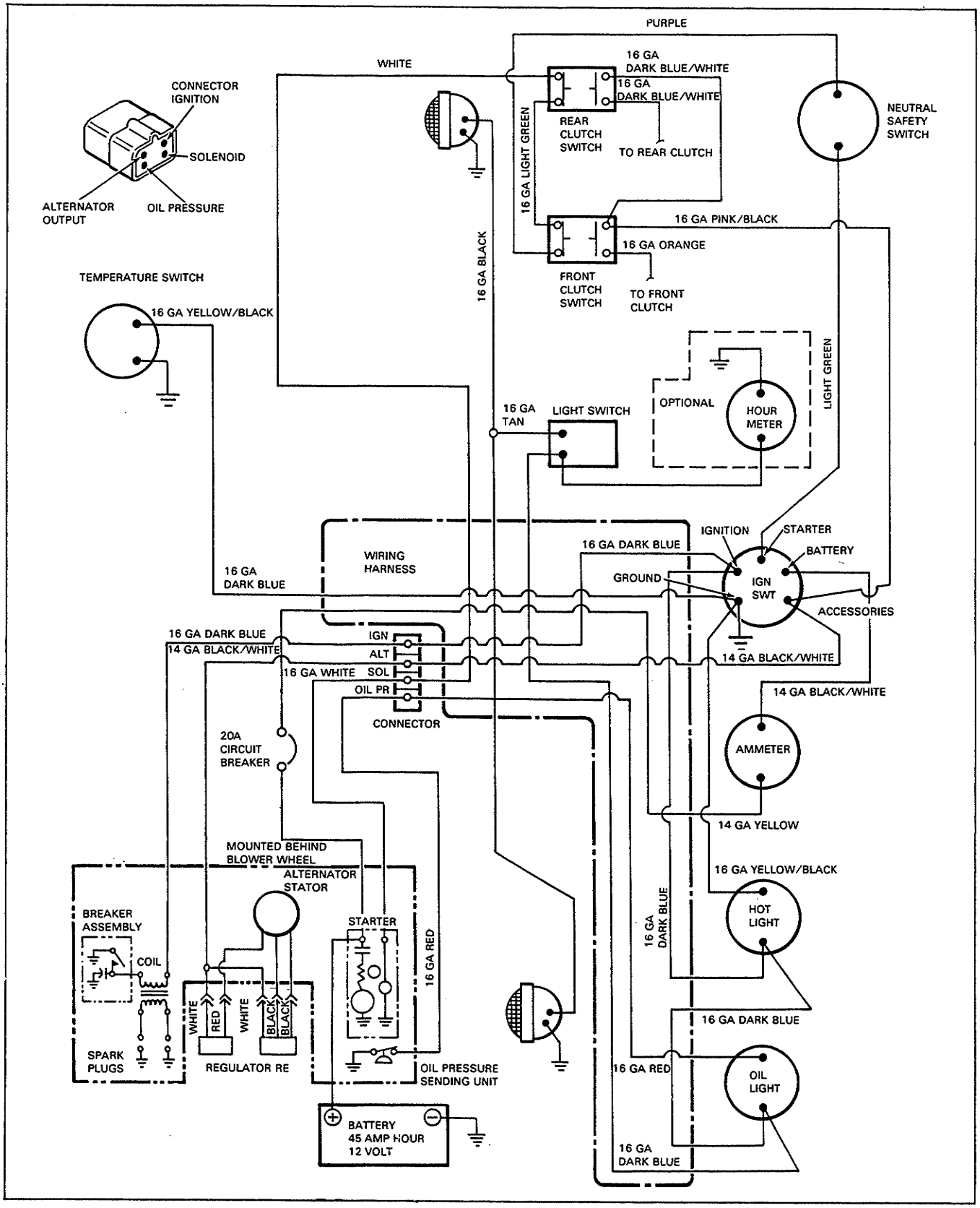


Figure 70. Electrical Wiring Diagram (4041, Pow'r Max. 9020)

ELECTRICAL SYSTEM

Description

The electrical system consists of six major circuits.

1. Battery.
2. Charging and ignition.
3. Starting.
4. Lights and hourmeter.
5. Pressure and temperature sending unit.
6. Power take-off.

To understand how each relates to the system, refer to Figures 69 and 70.

General Checkout Procedures

Determine in which circuit the malfunction occurs. Then isolate the malfunction and check the circuit for opens, grounds and/or shorts using a battery operated test lamp or ohmmeter. Replace the defective component and/or wiring and recheck the circuit.

⚠CAUTION

Before testing with an ohmmeter or battery operated test lamp, always disconnect the 12-volt battery.

An open is a break or interruption in the circuit. It is found by placing a battery operated test lamp or ohmmeter's leads on the extreme ends of the circuit being tested. The test lamp should light and the ohmmeter should show a reading if the circuit is closed.

A ground occurs when any part of the circuit is touching the tractor frame or when copper from the circuit is touching iron. Disconnect the ends of the circuit to be tested and any circuits attached in parallel to it, so you do not pick-up any other circuit grounds. A ground is found by placing one test lamp or ohmmeter lead on either end of the circuit to be tested and the other lead on the frame. The test lamp should light and the ohmmeter should show a reading if the circuit is grounded.

A short occurs when insulation breaks down and copper touches copper. A short is found by placing one test lamp or ohmmeter lead on one end of the circuit to be tested and the other lead on as many wires as may come into contact with the circuit being tested. Plugs, connections, and the wiring harness are probable areas of contact. The test lamp should light and the ohmmeter should show a reading if the wires have shorted together.

Components may be shorted internally. Correct resistances must be known between outside terminals, and if resistance is lower than specified, the component may be shorted internally.

NOTE

When grounds or shorts occur, amperage goes up and the circuit breaker may open.

Wiring Harness

During the following circuit check out procedures, wires within the harness may be found to be open, shorted, or grounded. If such a condition is found, the entire wiring harness must be replaced. Refer to Figures 71 and 72 for the harness wiring and connections.

To completely check the wiring harness, proceed as follows. Disconnect the battery and remove the harness from the tractor.

To check for opens, determine the terminal ends of the wire being tested, and place the test lamp or ohmmeter's leads at these ends. The test lamp should light or the ohmmeter should show a continuity reading if the wire is closed.

Check the condition of the wire insulation on the wires outside of the wiring harness covering. If the insulation is worn and copper is exposed, the wire may provide a ground when the harness is installed.

To check for shorts, place the test lamp or ohmmeter leads, in turn, on each connection. For example, place one lead on the ammeter's positive, black/white connection and the other lead, in turn, on all other connections. If the test lamp lights or the ohmmeter shows a reading, the wires being tested are shorted to each other. Proceed to the next harness wire, and so on, until all the harness wires are checked.

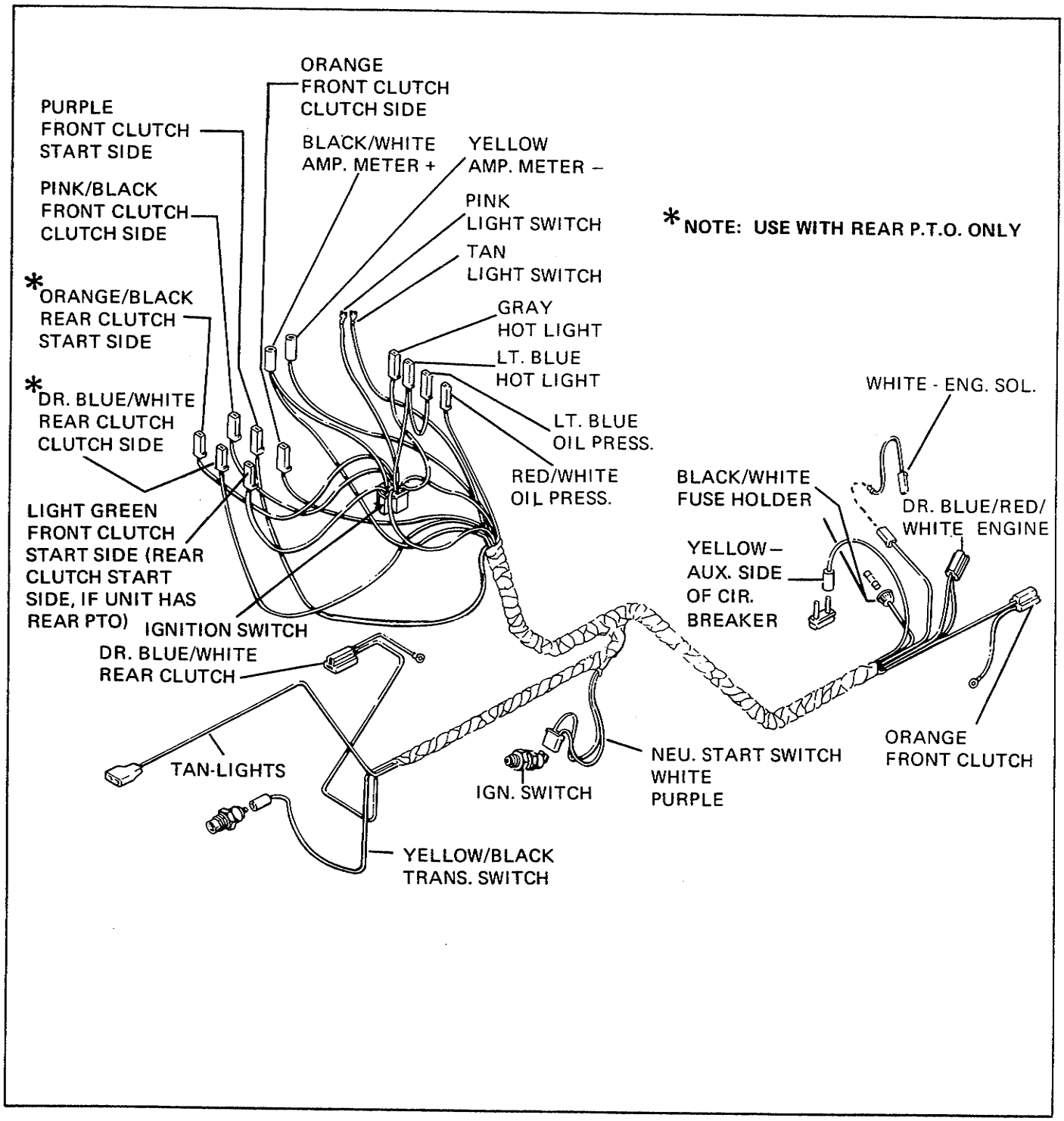


Figure 71. Wiring Harness (4040)

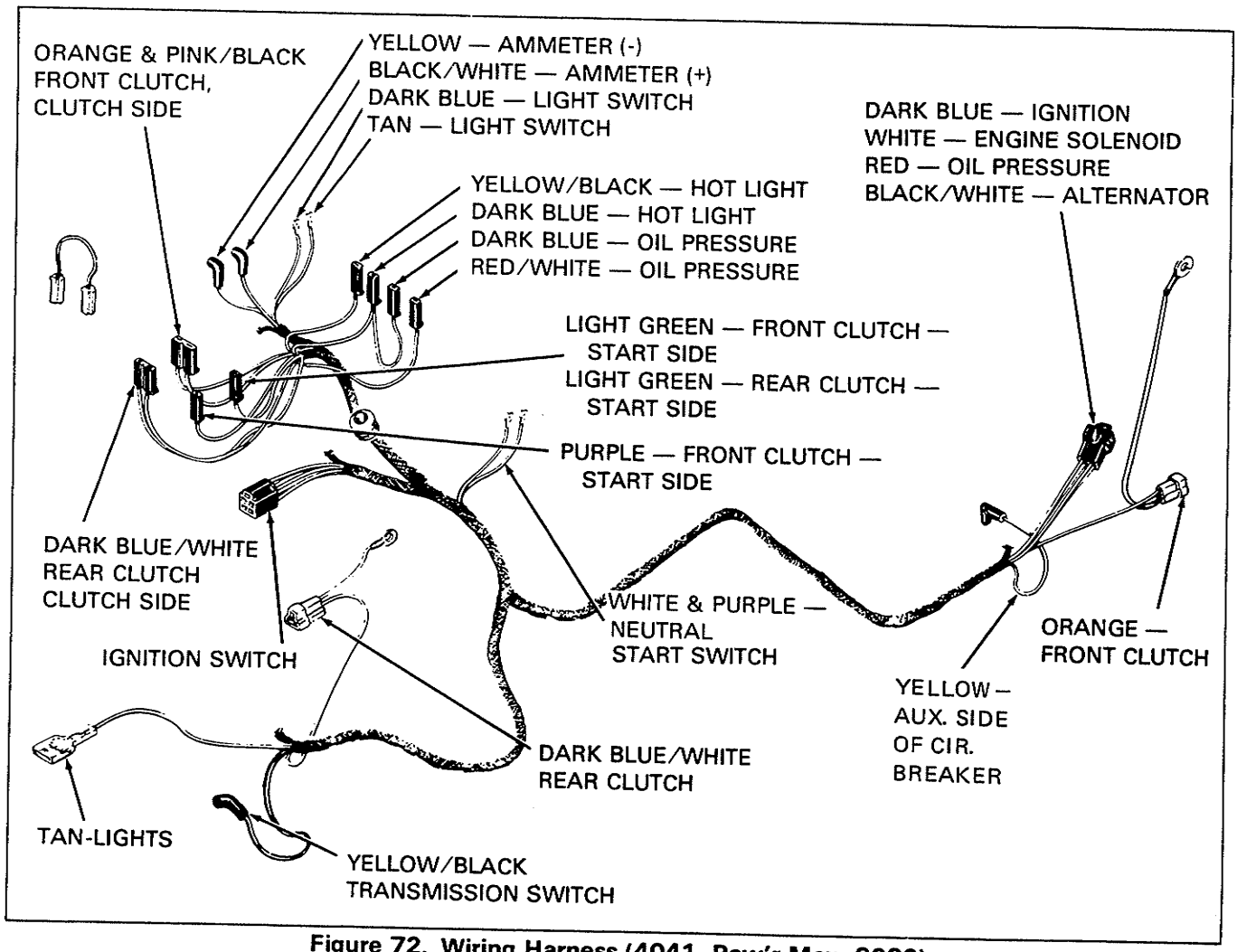


Figure 72. Wiring Harness (4041, Pow'r Max. 9020)

Battery Circuit (Figure 73 and 74)

For the battery to supply the required current to the tractor starter and accessories and to accept a charge from the alternator, it must be in good condition, and the wiring circuit from the ammeter to the battery must be closed and not shorted or grounded.

Battery Condition

The size and performance of the battery should be equal to or greater than 45 ampere-hours, 12 volts. The battery voltage rating, 12-volts, must be the same as the voltage rating of the starter motor.

Battery state-of-charge can be checked by taking a hydrometer reading, for the specific gravity, in each battery cell. The reading should be 1.265-1.275 when the room, battery, and electrolyte temperatures are 70-100 degrees F.

Replace the battery when one or more cells will not read above 1.225 specific gravity on the hydrometer after attempting to charge the battery. Before attempting to charge the battery, be sure the electolyte level is above the plates and the filler cap vent holes are open.

Battery Wiring

Be sure the circuit is wired correctly and that all connections are clean and tight. Refer to Figures 73 and 74, Battery Circuit.

Use a voltmeter to check the voltage to frame ground at test point 2 and 3. If voltage is not obtained at test point 3, the circuit breaker is open, or there is a ground or short in the battery or related circuits. If voltage is obtained at test point 3, the circuit is closed with no grounds or shorts functionally affecting it.

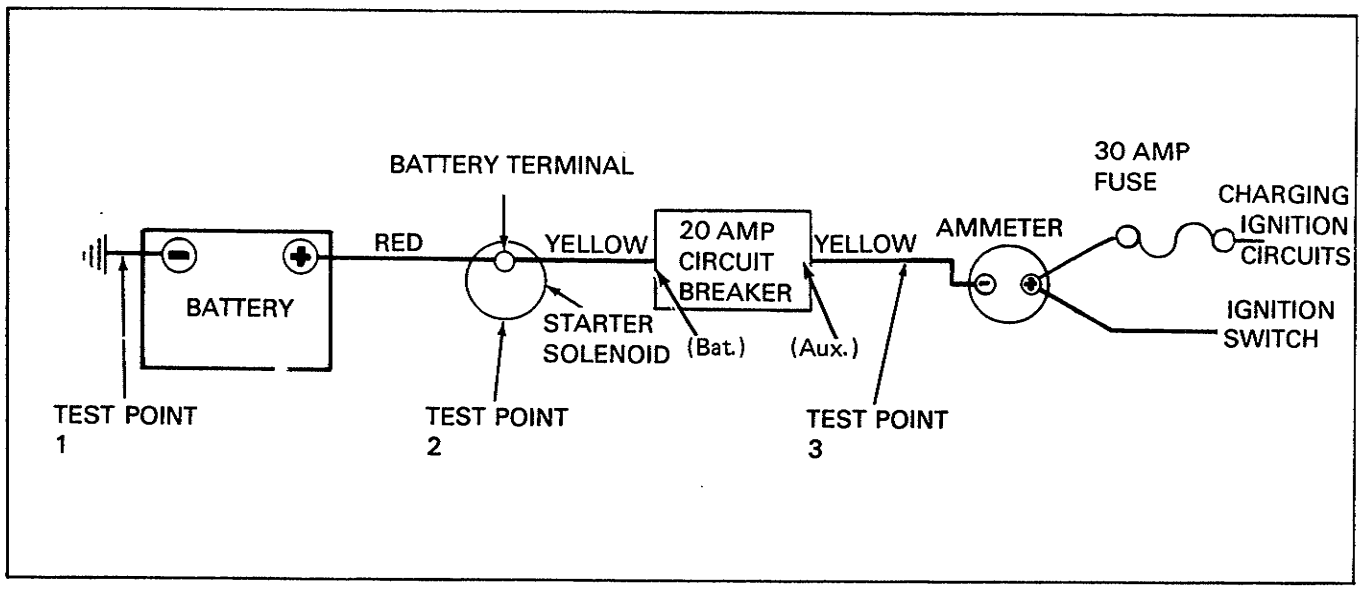


Figure 73. Battery Circuit (4040)

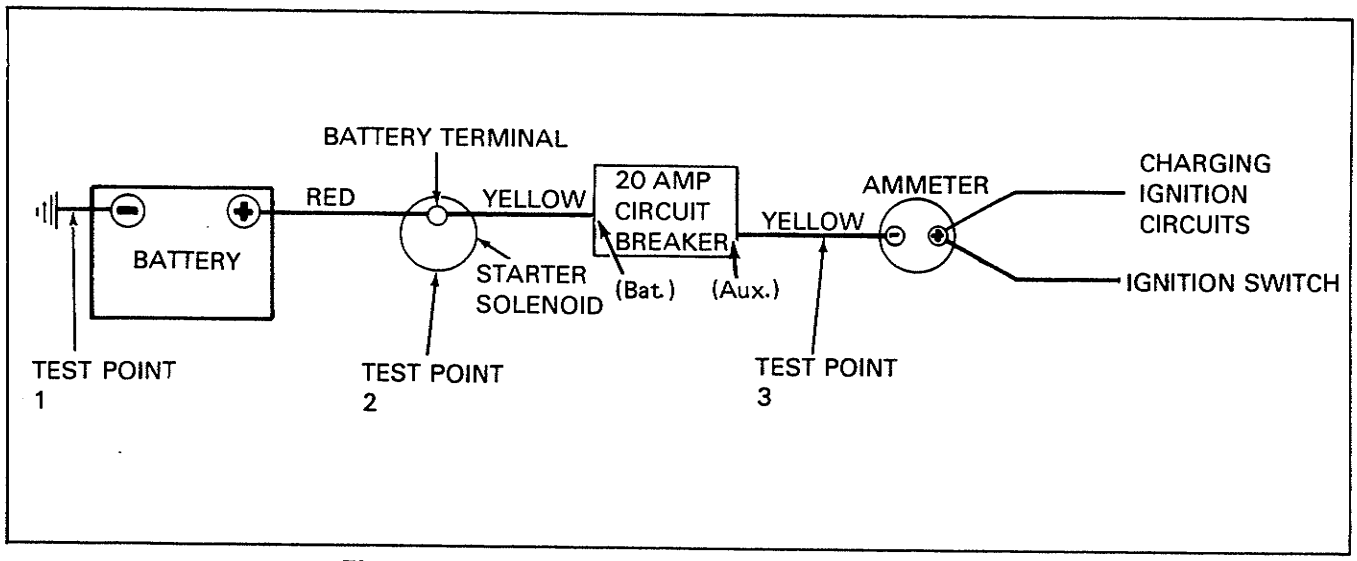


Figure 74. Battery Circuit (4041, Pow'r Max. 9020)

CHARGING CIRCUIT (Figures 75 and 76)

Description

The function of the charging circuit is to restore to the battery the chemical energy which is used by the electrical accessories. This is accomplished by sending current through the battery in a direction opposite to the direction of current during discharge. The alternator rectified current reverses the chemical actions in the battery and restores it to a charged condition.

During actual operation when the alternator is not running, the battery alone supplies the current to the accessories. The ammeter shows the direction of current flow, which, in this case, will read discharge (-). Under certain speed and load conditions, the alternator and battery both supply load current. In this case also, the ammeter should read discharge (—). As alternator speed increases, the alternator provides all the current needed to operate the accessories and charge the battery. The ammeter should read charge (+) until the voltage regulator senses a charged battery condition and limits the charge current.

To limit the alternator voltage to a safe value and to change alternating current to direct current, a regulator and rectifier is included in the charging circuit.

NOTE

Overcharging causes a loss of water in the battery by disassociating the water of the electrolyte into hydrogen and oxygen gases. The gas bubbles wash active materials from the plates, and reduce the capacity. If not replaced, this loss of water will cause the electrolyte level to fall below tops of the plates causing the plates to harden and become chemically inactive. Overcharging also causes high internal heat and the oxidation of the positive plate grids, resulting in loss of cell capacity and early failure.

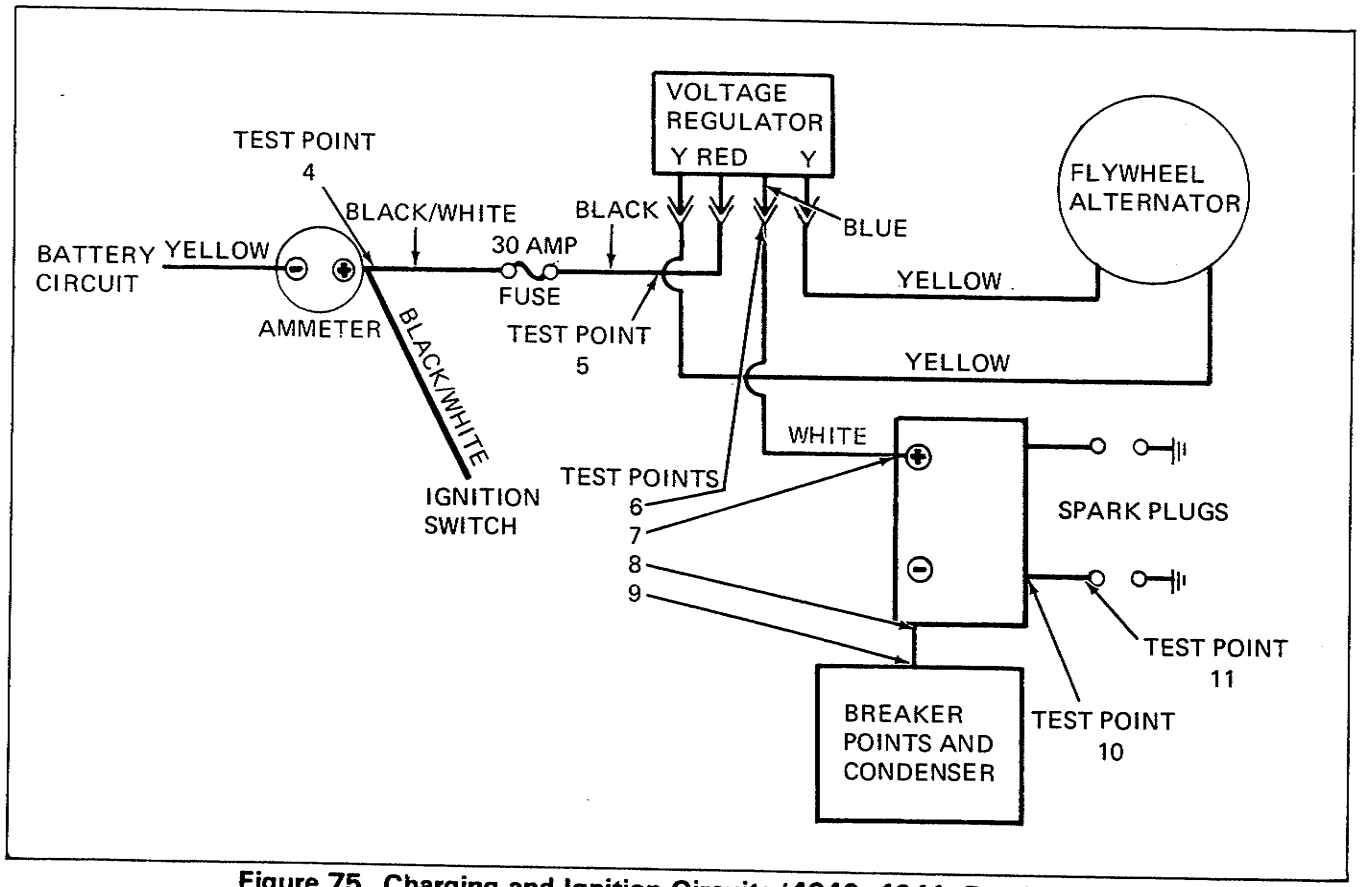


Figure 75. Charging and Ignition Circuits (4040, 4041, Pow'r Max.)

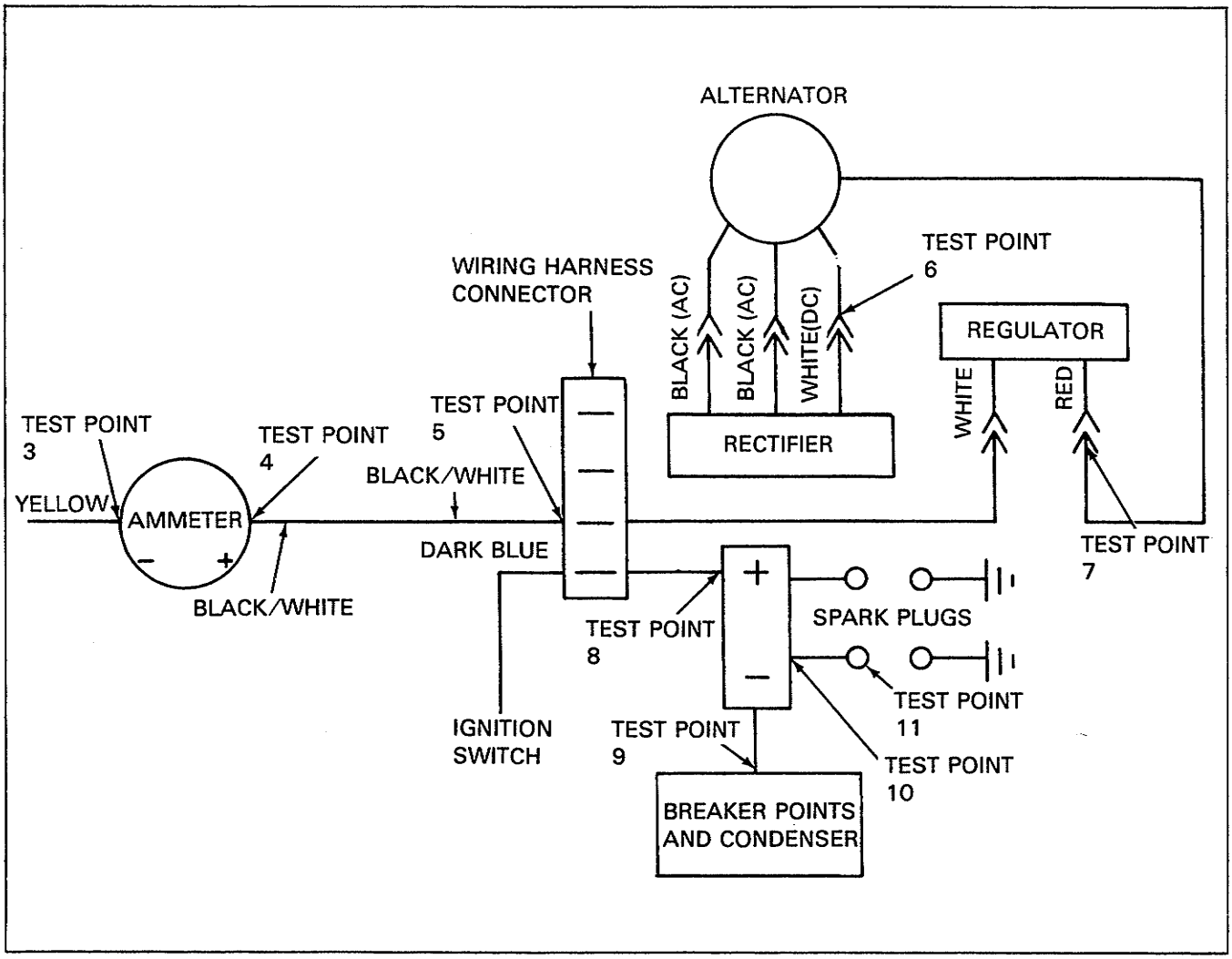


Figure 76. Charging and Ignition Circuits (9020)

NOTE

A battery which is consistently undercharged will develop sulfated plates. The sulfate normally formed in the plates will become dense, hard, and chemically irreversible, if allowed to remain in the plates for an extended period. The lowered specific gravity levels make the battery more susceptible to freezing. Also, an undercharged battery will tend to fail to crank in cold weather because of the loss of the reverse capacity resulting from undercharging.

On some models, a 30 ampere fuse protects the alternator stator windings in case battery cables are accidently reversed. Check to see that the battery cables are in proper position and replace the fuse if it is blown.

To provide adequate charging current to maintain the battery in a charged condition, it is necessary that:

1. The battery be in a chargeable condition;
2. The wiring circuit from the ammeter (+side) to the alternator be closed and not grounded or shorted;
3. The alternator current be rectified to direct current and the direct current voltage be regulated in 13.4 to 14.7 vdc at the voltage rectifier and regulator;
4. Alternating current be produced by the permanent magnet flywheel alternator.

Charging Circuit Check (Figure 75 and 76)

1. Connect a voltmeter across the battery. Start the engine and operate at 1800 to 3600 rpm. If the voltmeter reads 13.4 to 14.7 vdc, no further testing is required. If the voltage is below 13.4 vdc, above 14.7 vdc, or is non-existent, continue the check procedure.
2. Make sure the battery is in chargeable condition.
3. Make sure the wiring circuit from the ammeter's positive side to the alternator is closed and not grounded or shorted.
4. Use a voltmeter to check the voltage from both test points 3 and 4 to the tractor frame. If there is a voltage reading at test point 3, but not at test point 4, the ammeter is open. If a voltage reading is obtained when placing one lead on the ammeter case and the other on the frame ground, the ammeter is grounded to the case. Replace the ammeter if it is open or grounded.
5. On the 4040 tractor, disconnect the voltage regulator plug at test point 5 on Figure 75. Note the connection of the two middle pairs of wires. The red must be with the black and the black with the white. Use a voltmeter to check the voltage from the black wire terminal to ground. If the voltmeter shows a reading, the circuit is closed to that point. Reconnect the plug. Make sure the wires are properly mated.
6. Make sure the rectifier and regulator has a good, clean ground connection. Connect a voltmeter across the rectifier and regulator. Start the engine and operate at 1800 to 3600 rpm. If the voltage is below 13.4 vdc, install a new rectifier and regulator and recheck. Note that the regulator/rectifier must be mounted before rechecking. If the voltage remains below 13.4 vdc, proceed to the flywheel stator check.
7. Start the engine and operate at 1800 to 2600 rpm. If no charging is evident on the ammeter, proceed with the no charge test. If the ammeter shows a constant high charge rate, follow the high charge rate test.
8. The flywheel magnets should be treated in the same manner as the standard magneto flywheel. There is very little testing that can be done in the field other than to lay a piece of ferrous (iron) material up against the magnets to be sure they are charged or to replace the magnet group.

⚠CAUTION

Be sure to check the torque of the bolts fastening the magnet ring group to the flywheel. The torque should be 60-80 inch-pounds (approximately 5 foot-pounds).

No Charge Test

1. Use a DC voltmeter to check the battery positive to ground voltage.
2. If the voltmeter shows 13.8 volts or higher, add a load to the system, such as switching on the headlights, to reduce the battery voltage to 13.6 volts or below.
3. Observe the ammeter. If the charge rate increases, consider the system in satisfactory condition. If the charge rate does not increase, proceed with testing.
4. Disconnect the plug from the rectifier at test point 6. Test the AC voltage at the plug with the engine running near 3600 rpm. If the AC voltage is less than 28 volts, replace the stator. If the AC voltage is more than 28 volts, replace the rectifier and regulator.

High Charge Rate Test

1. Use a DC voltmeter to check the battery positive to ground voltage.
2. If the voltmeter shows 14.7 volts or higher, replace the rectifier and regulator.
3. If the voltmeter shows under 14.7 volts, the system is probably operational. Recheck the battery and connections. If the battery does have a low charge, but accepts recharging, the system is operational.

Flywheel Stator Check (Figures 75 and 76)

1. Make sure the engine is not running. Disconnect the battery, and the regulator connector at test point 7.
2. Connect the leads of an ohmmeter to the two outside terminals of the female plug. If no reading shows on the ohmmeter, the stator winding is open and the stator must be replaced.
3. Connect one lead of the ohmmeter to one of the outside terminals of the female plug and the other lead to the metal core. If the meter shows a reading, the stator winding is grounded and the stator must be replaced.

IGNITION CIRCUIT (Figures 75 and 76)

Description

Fuel combustion depends upon the correct fuel-air mixture being supplied to the spark plugs and sufficient voltage surges to ignite this mixture at a specific time. To provide the fuel-air mixture, it is necessary that the fuel system (the carburetor, fuel pump, and air cleaner) function properly. Refer to the Onan service manual for fuel system repair.

To provide the high voltage surges that will simultaneously jump the two spark plug gaps and ignite the fuel-air mixture, it is necessary that:

1. The timed high voltage jump the spark plug gaps and ignite the fuel-air mixture;
2. The voltage be timed by the breaker points and condenser;
3. The battery voltage be transformed to high voltage in the coil;
4. The wiring circuit from the battery to the spark plugs be closed and not grounded or shorted.

Ignition Circuit Check

Spark Plugs

1. Remove the spark plugs from the engine and examine them carefully. Make sure there is a clear air gap of 0.025 of an inch between the electrodes at the firing end. If the electrodes have a burned appearance, or if the porcelain at the firing end of the plug is wet, cracked or broken, or coated with wet carbon, replace the plug.
2. Connect one spark plug to a spark plug wire. Lay the plug flat on the metal of the engine. Make sure the top end of the plug is at least 1/4 inch away from metal. Crank the engine and observe if a spark occurs at the gap between electrodes.
3. If a blue spark accompanied by a snapping sound is observed, the spark should jump the gap. If a spark does not occur, continue with this checkout procedure. If a snapping blue spark does occur, the ignition circuit is functioning properly. If this is the case, adjust the gap of both plugs to 0.025 of an inch. Screw the plugs back into the engine. Secure the spark plug wires to the plugs.

Breaker Points and Condenser

Breaker point contacts in normal, good condition have a grayish color and may have numerous small pits. If the contacts are deeply pitted, they should be replaced, and the system should be checked to locate and correct the cause.

Usual causes of pitting or burning are too small of a gap between contacts, a defective condenser, or oily vapors condensing on the contact surfaces.

Change the breaker points by the following procedure (Figure 77).

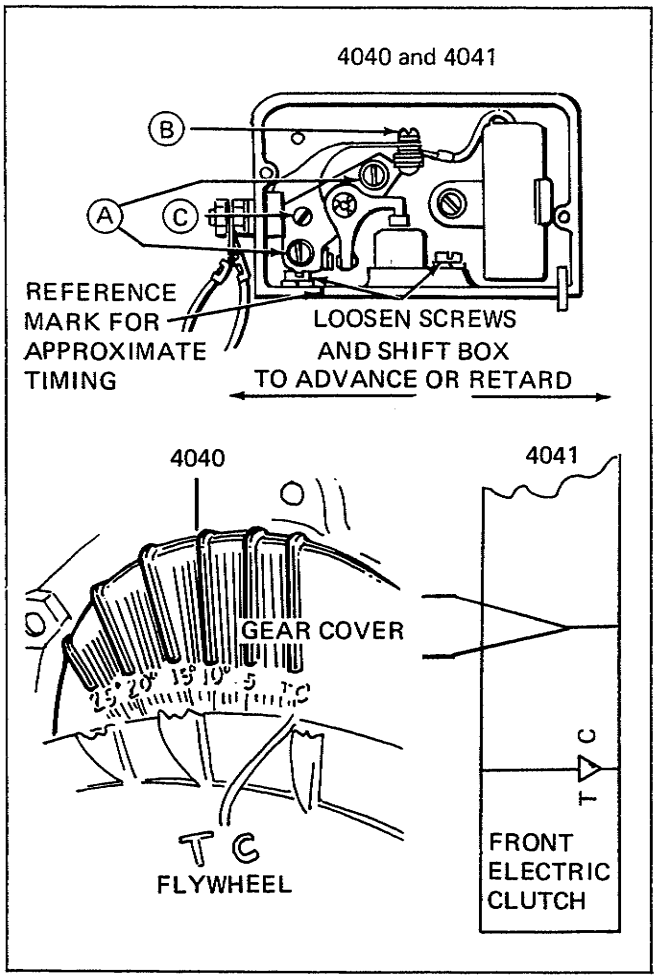


Figure 77. Ignition and Timing Adjustment

1. Remove the two mounting screws and the cover of the breaker box.
2. Remove the two spark plugs so the engine can be easily rotated by hand.

NOTE

If the plugs have not been changed within the last 100 hours, install new ones after setting the breaker points.

3. Remove the two mounting screws (A) and pull the points out of the box just far enough so the screw (B) can be removed. Replace the points with a new set, but do not completely tighten the mounting screws (A).
4. On the 4040 tractor, rotate the engine clockwise, facing the flywheel, by hand until the TC mark on the gear cover aligns with the TC mark on the fly wheel. On all other models, align the arrow on the camshaft with the front electric clutch as shown. Then, turn the screw (C) until the point gap measures 0.020 of an inch. Use a flat thickness gauge to measure the gap.
5. Tighten the mounting screws (A) and recheck the gap.

Check the ignition timing by the following procedure.

1. Connect a continuity test lamp across the ignition breaker points. Touch one test lead to the breaker terminal that is connected to the coil lead, and touch the other test lead to a good ground on the engine.
2. Turn the crankshaft counterclockwise until the points close. Then slowly turn the crankshaft clockwise.
3. The test lamp should go out just as the points break. This is the time at which ignition occurs.

NOTE

Install a new condenser whenever new breaker points are installed.

Coil

If the coil is suspected of malfunctions, replace it. Refer to the Onan service manual's parts catalog for the correct part number.

Wiring Circuit

Make sure the circuit is wired correctly. Refer to Figures 75 and 76, Charging and Ignition Circuits. Then check the spark plug wires at test points 10 and 11, the wire from the ignition switch to the coil at test points 6 and 7, and the breaker point wiring at test points 8-9, for opens, grounds, or shorts.

⚠ CAUTION

Make sure the battery is disconnected before testing.

STARTING CIRCUIT (Figures 78 and 79)

The starter motor's cranking output is dependent upon:

1. The condition of the battery and battery circuit;
2. The wiring circuit from the ignition switch to the starter solenoid;
3. Engine cranking requirements;
4. Starter motor and solenoid condition

Starting Circuit Check

Battery and Battery Circuit

Check the condition of the battery and battery circuit.

Wiring Circuit

Make sure the circuit is wired correctly and all connections are clean and tight. Refer to Figures 78 and 79, Starting Circuit.

The starter circuit, from the ignition switch to the starter, is closed when the ignition switch is placed in the start position, the transmission control lever is in the neutral position, and the PTO switches are in the off positions.

Ignition Switch

The ignition switch functions to provide an open or closed contact condition between different groupings of its terminals. In the off position, no contact is made between any of the terminals. In the on position, the battery, ignition, and accessory terminals make contact, and in the start position, the battery, ignition, starter, and ground terminals make contact.

To test whether the ignition switch makes or breaks contact at the correct terminals, use the following procedure.

1. Disconnect the battery.
2. Place the ignition switch in the off position. Touch one lead from an ohmmeter to one of the switch's terminals and the other lead, in turn, to all the other terminals and to the switch's case. Repeat the procedure for each terminal. If the ohmmeter shows a reading, the ignition switch is shorted between terminals, or one or more terminals are grounded to the case. The switch must be replaced.

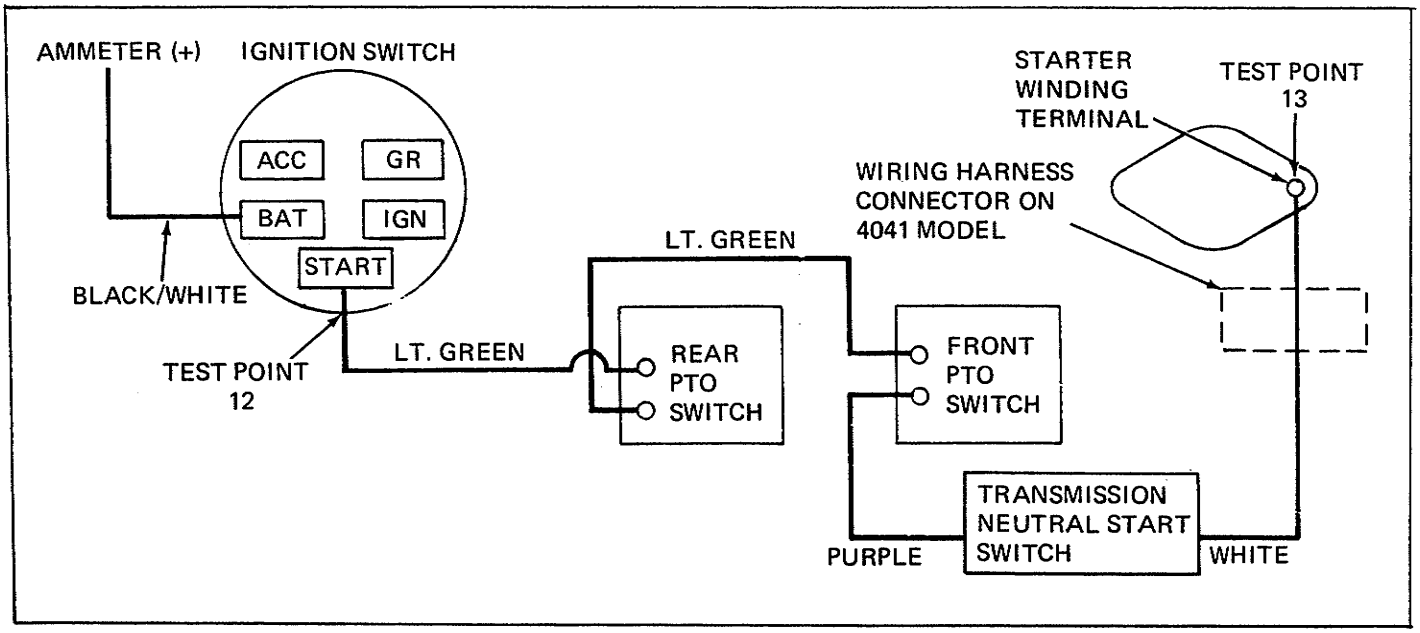


Figure 78. Starting Circuit (4040)

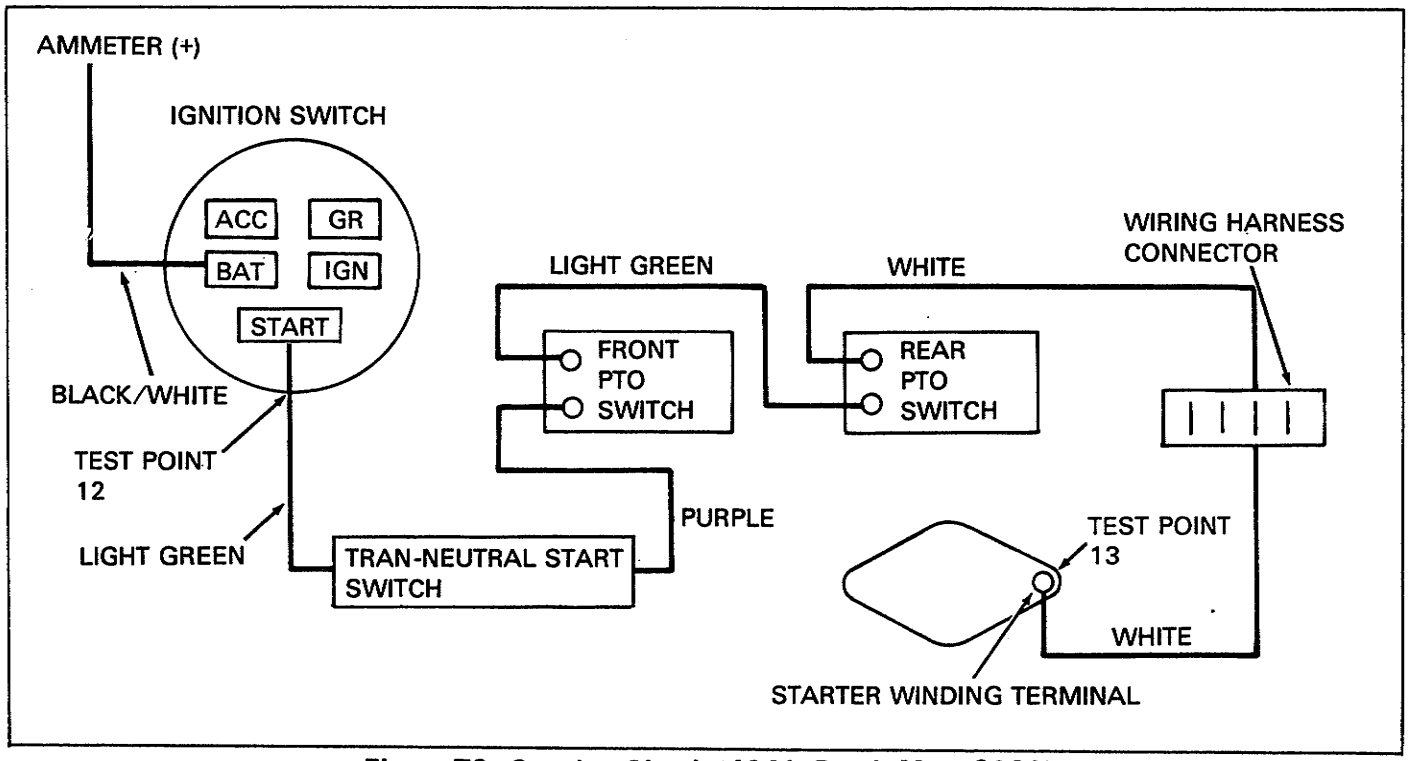


Figure 79. Starting Circuit (4041, Pow'r Max. 9020)

3. Place the ignition switch in the run position. Touch one lead from the ohmmeter to one of the switch's terminals and the other lead, in turn, to all the other terminals. Repeat the procedure for each terminal. The ohmmeter should show a reading when the battery, ignition, and accessory terminals are touched. If the ohmmeter shows a reading between any other terminals, the switch is malfunctioning and must be replaced.
4. Place the ignition switch in the start position. Touch one lead from the ohmmeter to one of the switch's terminals and the other lead, in turn, to all the other terminals. Repeat the procedure for each terminal. The ohmmeter should show a reading when the battery, ignition, starter, and ground terminals are touched. If the ohmmeter shows a reading between any other terminals, the switch is malfunctioning and must be replaced.

NOTE

The ignition switch contains a spring return between the run and start positions. If the ignition switch key is released from the start position, it must return to the run position. Replace the switch if it does not return.

PTO Switch

The PTO switches function to provide an open or closed contact condition between two pairs of terminals. When the switch is in the off position, the upper pair of terminals are closed and the lower pair of terminals are open. When the switch is in the on position, the upper pair of terminals are open and the lower pair of terminals are closed. This arrangement of terminals makes it impossible to start the tractor and operate the PTO at the same time.

To test whether a PTO switch makes or breaks contact correctly, use the following procedure.

1. Disconnect the battery.
2. Touch one lead from an ohmmeter to the switch's case and the other lead, in turn, to each terminal. If the ohmmeter shows a reading, the terminal is grounded to the case internally, and the switch must be replaced.
3. Place the PTO switch in the off position. Touch one lead from the ohmmeter to terminal A, Figure 80, and the other lead to terminal B. Then place one lead on terminal C and the other lead on terminal D. The ohmmeter should only show a reading between terminals A and B. If there is a reading between C and D, the switch is malfunctioning and must be replaced.
4. Place the PTO switch in the on position. Touch one lead from the ohmmeter to terminal C and the other lead to terminal D. Then place one lead on terminal A and the other lead on terminal B. The ohmmeter should only show a reading between C and D. If there is a reading between A and B, the switch is malfunctioning and must be replaced.

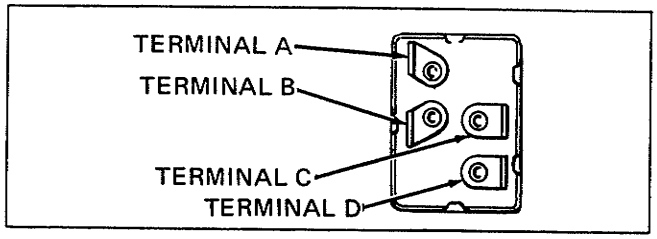


Figure 80. PTO Switch Terminals

To test for proper switch operation, use the following procedure.

1. Disconnect the battery.
2. Position an ohmmeter so that it can be read when you are seated in the operator's seat. Attach the leads from the ohmmeter to the terminals of the transmission neutral start switch.
3. Move the transmission control lever to all positions. The ohmmeter should show a reading only when the transmission control lever is in the neutral position. If the ohmmeter shows a reading in the forward or reverse positions or if there is no reading shown in any position, adjust the switch, and retest.
4. If, after adjustment, the ohmmeter does not show a reading when the transmission control lever is in the neutral position, manually activate the switch. Replace the switch if the ohmmeter does not show a reading.

Transmission Neutral Start Switch Adjustment

NOTE

It is recommended that neutral safety switch conversion kit #1685051 be installed on units having trouble with this switch.

To adjust the transmission neutral start switch on the 4040, 4041, Pow'r Max, and on 9020 tractor with Manufacturing No. 1690072, use the following procedure.

1. Remove the hole plug from the right side of the tractor frame.

   Some earlier models do not have this access hole. It is recommended that, if this hole does not exist, a 1 inch or 1-1/4 inch diameter hole be drilled on the right side of the tractor frame for future access to the neutral start switch.
2. Place the hydrostatic transmission control lever in the notched neutral position.
3. Turn the detent (A, Figure 81) until the switch closes. Then advance the detent 1/6 to 1/3 of a turn more.
4. Tighten the detent locknut (B) against the detent. Insure that the stud capscrew (C) is secure against the speed control lever (D) before adjusting detent (A).
5. Check the adjustment as outlined in Transmission Neutral Start Switch.
6. Replace the hole plug in the tractor frame.

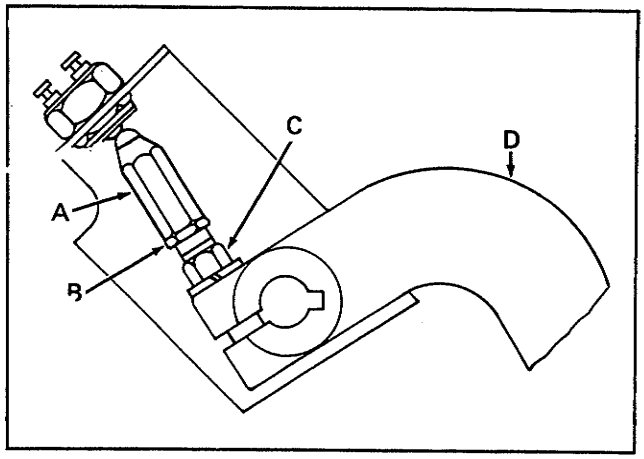


Figure 81. Neutral Start Switch (4040, 4041, Pow'r Max.)

To adjust the transmission neutral start switch on 9020 tractors with Manufacturing No. 1690230 or 1690283, use the following procedure.

1. Place the hydrostatic transmission control lever in the notched neutral position.
2. Place a pencil mark (B, Figure 82) on the quadrant (A) 1/16 of an inch from the rear edge of the block on the backside of the hydrostatic control lever.
3. Place another pencil mark (E) on the quadrant 1/16 of an inch forward of the front edge of the block on the backside of the hydrostatic control lever.
4. Move the hydrostatic control lever fully forward. Then move it slowly rearward. The safety switch (G) should click once as the front edge of the block passes the front pencil mark (E). It should click again as the rear edge of the block passes the rear pencil mark. If the switch does not click or clicks at the wrong time, adjust the switch by following the remaining procedures.
5. Move the hydrostatic control lever to its neutral notch. The roller (I) at the end of the switch lever should be centered on the switch actuator (F). If not, loosen the two screws (H) that secure the switch bracket. Move the bracket to center the roller on the actuator and tighten the screws.
6. Move the hydrostatic control lever forward until the front edge of the trigger lever is even with the front pencil mark.
7. Loosen the screws that hold the actuator (F). Move the actuator forward until the switch leaf arm almost touches the switch body. Then move the actuator away from the switch until the switch clicks. Tighten the screws to secure the actuator in this position.
8. Return to step 4 and repeat the check. Readjust if necessary. Then check the adjustment as outlined in Transmission Neutral Start Switch.

NOTE

Switch leaf arm should be at least 1/32 of an inch from the switch body when the hydrostatic control lever is in its neutral notch.

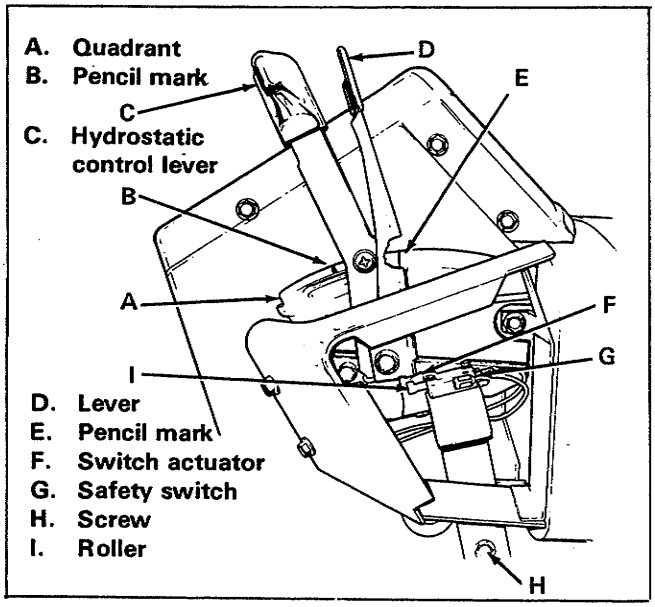


Figure 82. Neutral Start Switch (9020)

Wiring Circuit Check (Figures 78 and 79)

To check the starting circuit for open wiring, disconnect the battery, and touch one lead from an ohmmeter on the ignition switch start terminal at test point 12 and touch the other lead on the starter solenoid terminal at test point 13. If the ohmmeter shows a reading when the transmission control lever is in the neutral position, and the PTO switches are in the off position, the circuit wiring is closed.

To check for grounds or shorts in the starting circuit, follow the procedures outlined in General Checkout Procedures.

Engine Cranking Requirements

Follow the engine manufacturer's recommendation for the proper weight of engine crankcase oil. An oil heavier than specified lowers the crankshaft speed drastically at low temperatures, and it can cause the engine to fail to start.

Starter Motor and Solenoid Condition

NOTE

The engine must be removed from the tractor completely to test or repair the starter.

If the battery, wiring, and engine are in good working condition, the cranking motor and solenoid should be removed for testing. Turning the armature by hand, if practical before disassembling the cranking motor, will reveal any mechanical restrictions in operation. Refer to the Onan service manual for starter motor and solenoid disassembly, inspection, and testing.

LIGHTS AND HOURMETER CIRCUIT (Figure 83)

The lights and hourmeter operation is dependent upon:

1. The condition of the battery and battery circuits;
2. The operation of the charging circuit;
3. The wiring circuit from the ignition switch to the starter solenoid;
4. Light and hourmeter condition.

Lights and Hourmeter Circuit Check

Battery and Battery Circuit

Check the condition of the battery and battery circuit.

Charging Circuit

Check the condition of the charging circuit.

Wiring Circuit

Make sure the circuit is wired correctly and all connections are clean and tight. Refer to Figure 83, Lights and Hourmeter Circuit.

The hourmeter circuit, from the ignition switch to the hourmeter, is closed to a power source and the hourmeter operates when the ignition switch is in the run position. The circuit for the lights is closed when the ignition switch is in the run position and the light switch is in the on position.

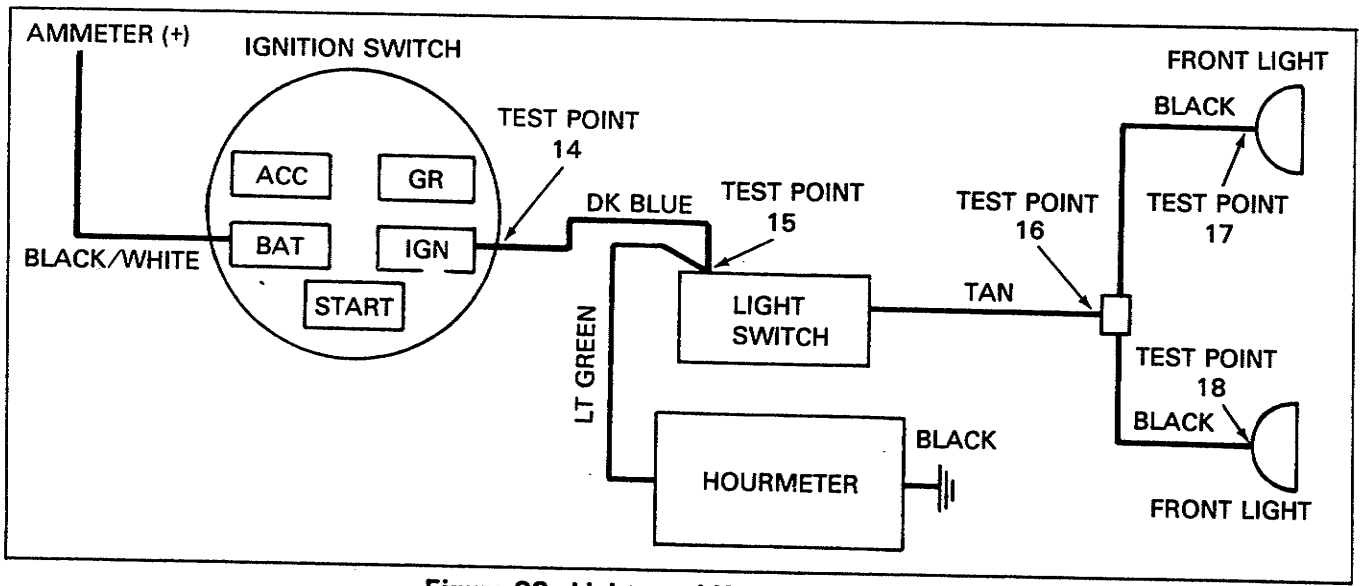


Figure 83. Lights and Hourmeter Circuit

Ignition Switch

Test the ignition switch to determine whether it makes or breaks contacts at the correct terminals.

Light Switch

The light switch closes the portion of the circuit to the rear and front lights. To test for proper switch operation, use the following procedure.

1. Disconnect the battery.
2. Attach the leads from an ohmmeter to each terminal of the light switch, and place the switch in the on position and then off position. The ohmmeter should show a reading only when the switch is in the on position. If the ohmmeter shows a reading when the switch is in the off position, replace the switch.
3. Touch one lead from the ohmmeter to the switch's case and the other lead, in turn, to both terminals. If the ohmmeter shows a reading on either terminal, the terminal is grounded to the case, and the switch must be replaced.

Wiring Circuit Check (Figure 83)

To check the lighting circuit for open wiring, disconnect the battery, and touch one lead from an ohmmeter on the ignition switch ingition terminal at test point 14 and the other lead, in turn, on the light terminals at test points 17 and 18. Place the light switch in the on position. If the circuit is closed, the ohmmeter should show a reading when the lead touches each light terminal.

If the ohmmeter does not show a reading, the circuit wiring is open and specific wire isolation is necessary. Maintain one lead from the ohmmeter on the ignition switch ignition terminal at test point 14 and place the other lead, in turn, on test points 16 and 15. When the ohmmeter shows a reading, the circuit between the reading and non-reading points is open and must be replaced. To check for grounds or shorts in the lights and hourmeter circuit, follow the procedures outlined in General Checkout Procedures.

Lights and Hourmeter

Make sure the meter is securely wired to the hot or battery side of the light switch and is grounded. Then place the ignition switch in the run position. Replace the meter if it is inoperative or if incorrect time is recorded.

Replace defective lights as required.

PRESSURE AND TEMPERATURE SENDING UNIT CIRCUIT (Figure 84)

The warning lights in the instrument panel are designed to light when transmission oil reaches an unsafe high temperature or when oil pressure to the moving parts of the engine is low. Illumination of these lights is dependent upon:

1. The condition of the battery and battery circuit;
2. The operation of the charging circuit;
3. The wiring circuit from the ignition switch to the warning lights and sending unit;
4. Warning light condition;
5. The sending units correctly monitoring temperature and pressure.

Pressure and Temperature Sending Unit Circuit Check

Battery and Battery Circuit

Check the condition of the battery and battery circuit.

Charging Circuit

Check the condition of the charging circuit.

Wiring Circuit

Make sure the circuit is wired correctly and all connections are clean and tight. Refer to Figure 84, Sending Unit Circuit.

The transmission temperature sending unit circuit is closed to a power source and the Hot light is illuminated when the ignition switch is in the run position and transmission oil exceeds 225 degrees F. At this temperature, the sending unit provides a ground. The Hot light also lights when the ignition switch is in the start position. This acts as a bulb check each time the engine is started.

The engine oil pressure sending unit circuit is closed to a power source and the Oil light is illuminated when the ignition switch is in the run position and engine oil pressure is low. Low pressure causes the sending unit to provide a ground.

Ignition Switch

Test the ignition switch to determine whether it makes or breaks contacts at the correct terminals.

Wiring Circuit Check (Figure 84)

To check the sending unit circuit for open wiring, disconnect the battery, and touch one lead from an ohmmeter on the ignition switch ground terminal at test point 20 and the other lead, in turn, on test points 21, 23, 25. If the circuit is closed, the ohmmeter should show a reading when the lead touches each light terminal.

If the ohmmeter does not show a reading, the circuit wiring is open and specific wire isolation is necessary. Maintain one lead from the ohmmeter on the ignition switch ground terminal at test point 20 and place the other lead, in turn, on test points 22 and 24. When the ohmmeter shows a reading, the circuit between the reading and non-reading points is open and must be replaced.

To check for grounds or shorts in the sending unit circuit, follow the procedures outlined in General Checkout Procedures.

Warning Lights

Replace defective lights as required.

Sending Units

Testing sending units requires simulating actual adverse pressure or temperature conditions and then measuring the units response. Consequently, it is not normally possible to test the unit for accuracy.

If either sending unit is suspected of malfunctioning, replace it with a certified accurate unit. The replacement unit must supply a ground to the warning light at the correct pressure or temperature.

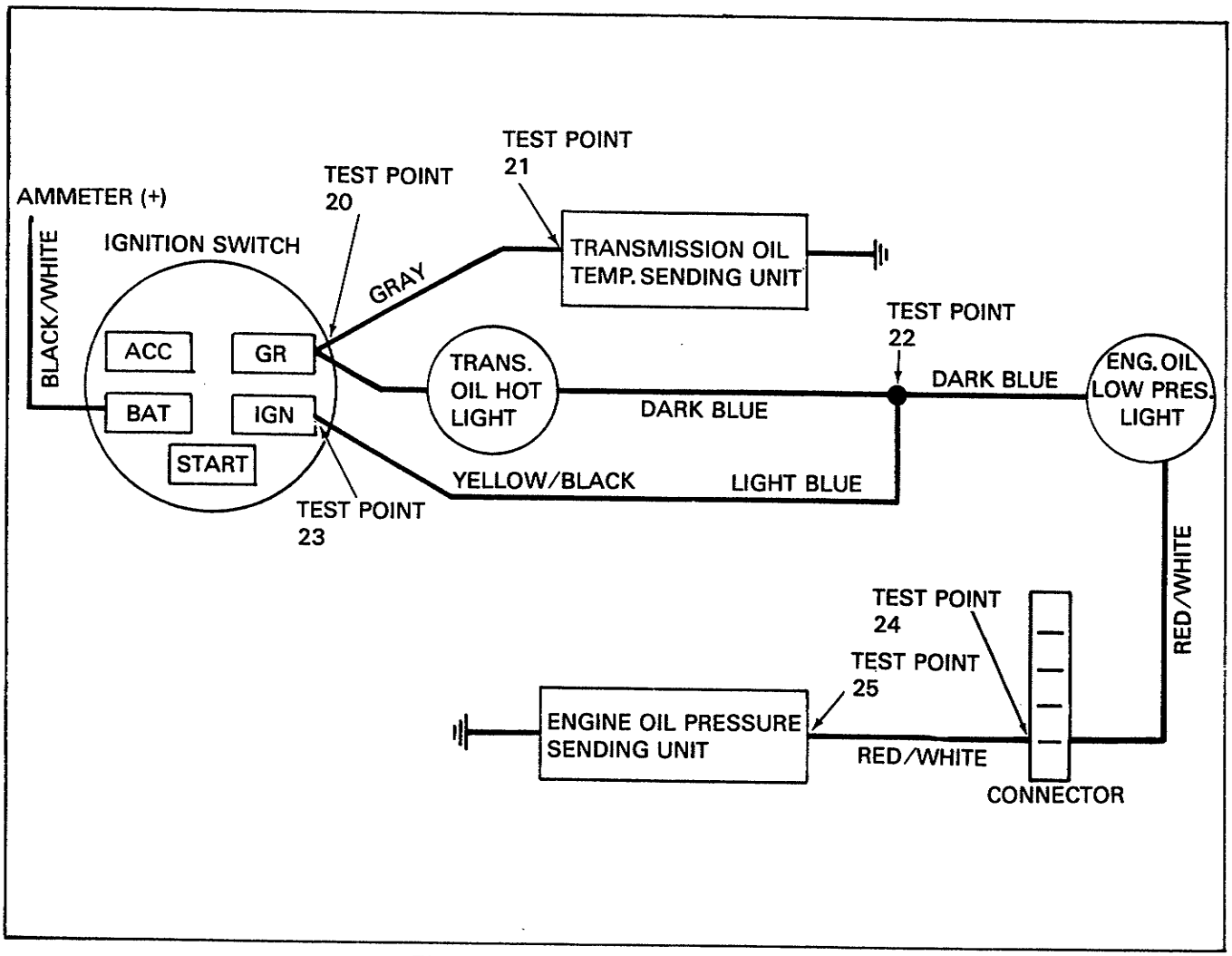


Figure 84. Sending Unit Circuit

PTO CIRCUIT (Figure 85)

The PTO clutches' operation is dependent upon:

1. The condition of the battery and battery circuit;
2. The operation of the charging circuit;
3. The wiring circuit from the ignition switch to the clutches;
4. Condition of the clutches.

PTO Circuit Check

Battery and Battery Circuit

Check the condition of the battery and battery circuit.

Charging Circuit

Check the condition of the charging circuit.

Wiring Circuit

Make sure the circuit is wired correctly and all connections are clean and tight. Refer to Figure 85, Power Take-Off Circuit.

Either clutch circuit is closed to a power source and the clutch is activated when the ignition switch is in the run position, and the power take-off switch is in the on position.

NOTE

The tractor cannot be started when either PTO switch is in the on position.

Ignition Switch

Test the ignition switch to determine whether it makes or breaks contacts at the correct terminals.

PTO Switches

Check the condition of the PTO switches.

Wiring Circuit Check (Figure 85)

To check the power take-off circuit for open wiring, disconnect the battery, and touch one lead from an ohmmeter on the ignition switch accessory terminal at test point 26 and the other lead, in turn, on test points 27 and 28. Place the PTO switches in the on position. If the circuit is closed, the ohmmeter should show a reading when the lead touches each test point.

If the ohmmeter does not show a reading, the circuit wiring is open. Replace the defective wiring or harness.

To check for grounds or shorts in the power take-off circuit, follow the procedures outlined in General Checkout Procedures.

Make sure the clutches are grounded securely and that the ground wire is not open.

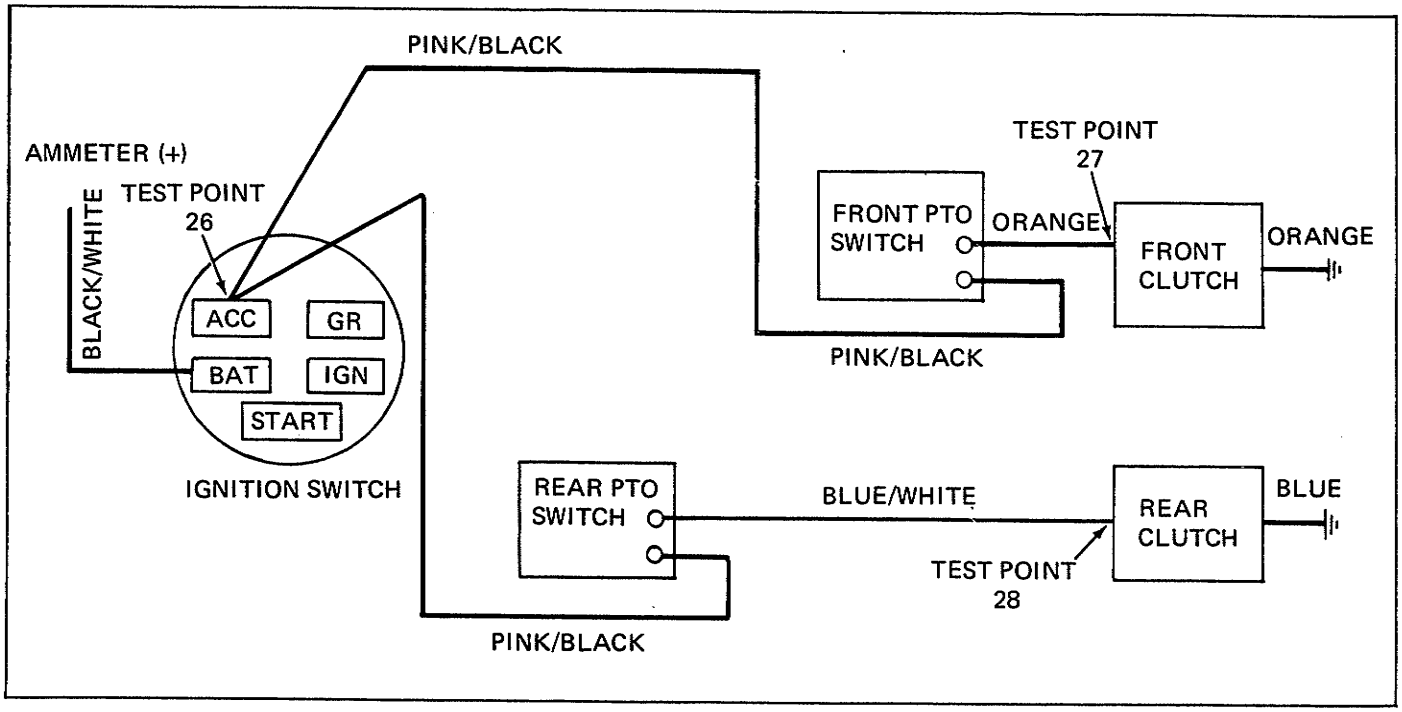


Figure 85. Power Take-off Circuit

Electric Clutch

The electric clutches consist of a field, rotor, and armature assembly. The field assembly can be checked by removing the clutch wire, either test point 27 or 28, and placing one lead from an ohmmeter in either female terminal and touching the other lead to ground. The usual resistance should read between 2.75 and 3.60 ohms. A reading outside of these values indicates a faulty coil, and the field assembly, which includes the coil, should be replaced.

REMOVAL AND INSTALLATION OF ELECTRICAL COMPONENTS

Starter and Flywheel Removal

1. Remove the engine. Refer to Engine Removal for removal procedures.
2. Loosen the clamping screw on the blower housing and remove the coil from the housing.
3. Remove the blower housing and right cylinder air housing from the engine.
4. Turn the flywheel mounting screw outward about two turns.

⚠ WARNING

Do not remove the flywheel mounting screw completely. It acts as a restrainer when the flywheel snaps loose. If the flywheel is not held by the screw, the spring action in the wheel will cause the wheel to fly off with great force which can cause personal injury.

5. Install a puller bar (Onan Part No. 420A100) on the flywheel as shown in Figure 86. Turn the puller bar bolts in, alternately, until the wheel snaps loose on the shaft.

⚠ CAUTION

Do not use a screwdriver or similar tool to pry behind the flywheel or against the gear case. The gear case cover is die-cast material and will break if undue pressure is applied in this manner.

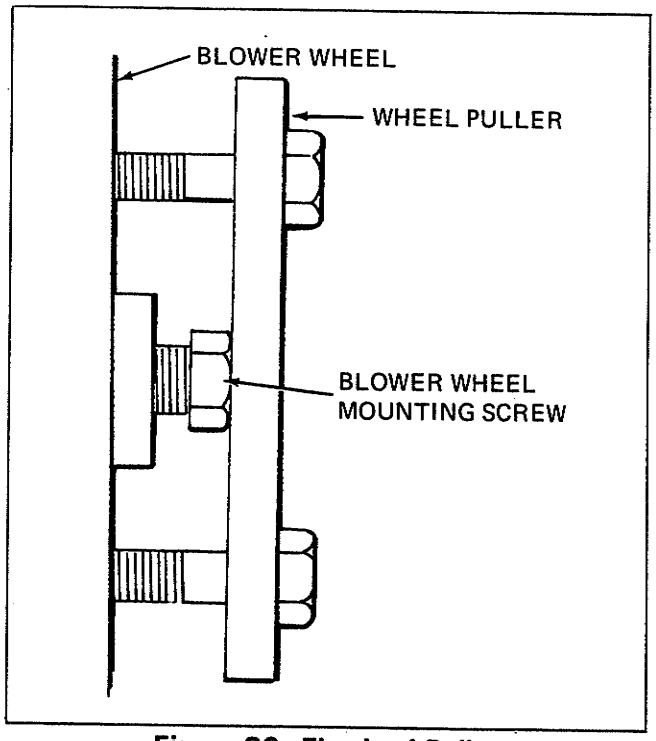


Figure 86. Flywheel Puller

6. Remove the puller bar from the flywheel. Remove the flywheel mounting screw and washer and pull the flywheel off the shaft. Take care not to damage the flywheel. A bent or broken fin will destroy the balance.
7. Remove the three starter mounting capscrews and remove the starter from the mounting bracket.
8. Refer to the Onan service manual for starter disassembly, inspection and overhaul.

Instrument Panel Component Removal (Figures 87 and 88)

1. Disconnect the battery.
2. Remove the spring clip from the choke cable and the clamp from the throttle cable. Loosen the governor control swivel screw on the engine. Then disconnect the cables from the carburetor.
3. Remove the steering wheel and its rubber washer by removing the 5/16-18 x 1-1/4 inch long capscrew and locknut securing them to the steering shaft.

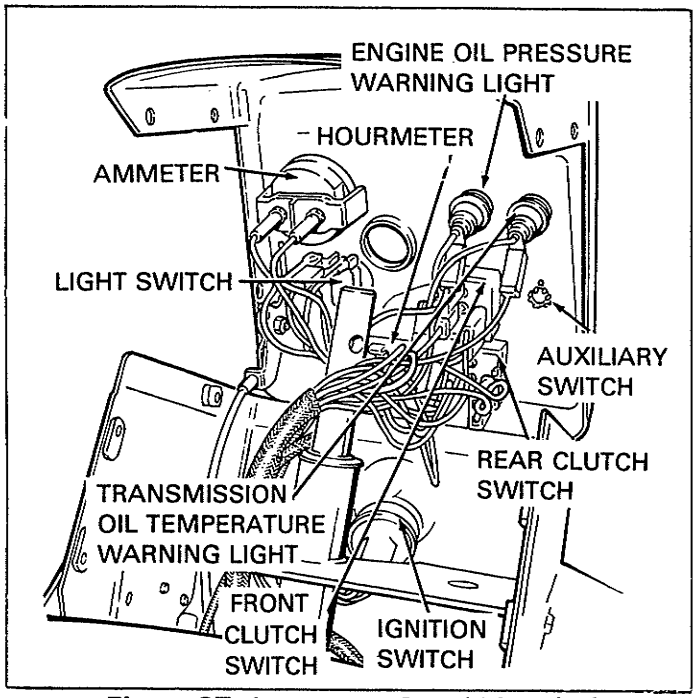


Figure 87. Instrument Panel Electrical Components (9020)

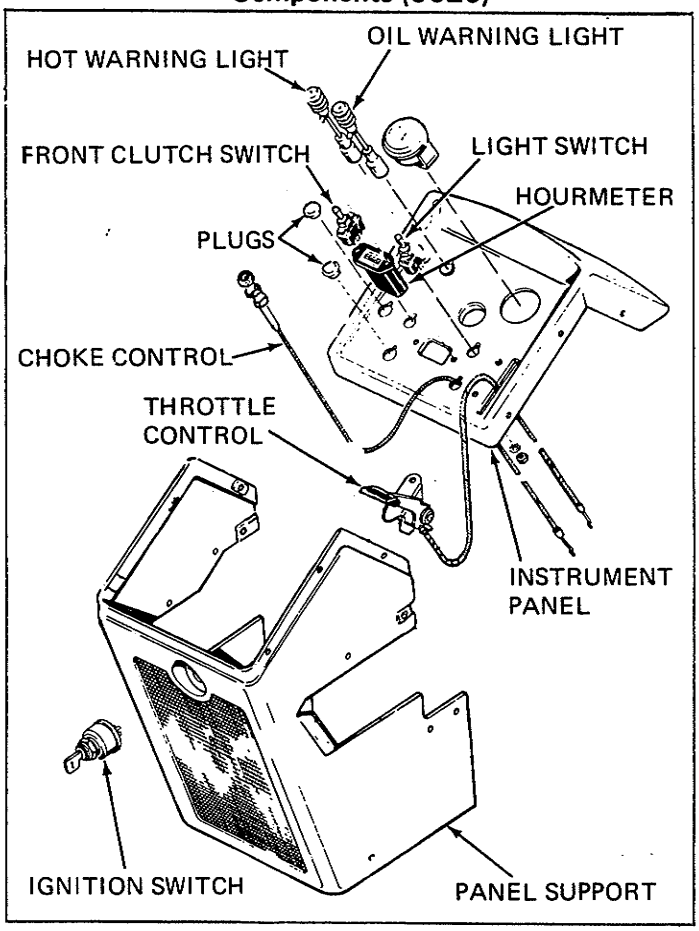


Figure 88. Instrument Panel and Support (9020)

4. Remove the six screws attaching the instrument panel assembly to the body support assembly. Carefully lift the panel up and over the steering shaft using caution not to disconnect or break the instrument wire connections.
5. Remove components from the instrument panel.

Front PTO Clutch Removal (Figure 89)

1. If a front attachment is mounted to the tractor, remove the drive belt from the clutch pulley.
2. Disconnect the clutch field assembly wire from the switch wire at the connector.
3. Remove the four 5/16-18 x 1-1/2 inch long capscrews securing the clutch pulley to the clutch armature assembly. Remove the clutch pulley.
4. On 9020 tractors with Manufacturing No. 1690230 or 1690283, alternately loosen the four nuts holding the clutch brake drum assembly to the four mounting studs. Carefully remove the nuts, springs, and brake drum assembly.
5. Remove the capscrew, lockwasher, and flat washer securing the clutch assemblies to the engine crankshaft. Remove the clutch armature assembly and key from the crankshaft.
6. Remove the four capscrews and lockwashers securing the clutch field assembly to the engine block.

Front PTO Clutch Installation (Figure 89)

1. Install the field assembly on the engine block face. Make sure the field pilot tabs are properly aligned. Secure the assembly to the engine block with the four mounting capscrews and lockwashers.
2. Remove any rust, burrs, or dirt from the engine crankshaft with sandpaper. Apply a light coat of grease or oil to the shaft and insert the key in the shaft keyway. If the key is damaged or worn, replace with a new key.
3. Slide the clutch armature assembly on the engine crankshaft until the bearing stops against the shaft end. Secure the armature assembly to the shaft with the capscrew, lockwasher, and flat washer. Hold the clutch assembly to prevent rotating when tightening the capscrew.

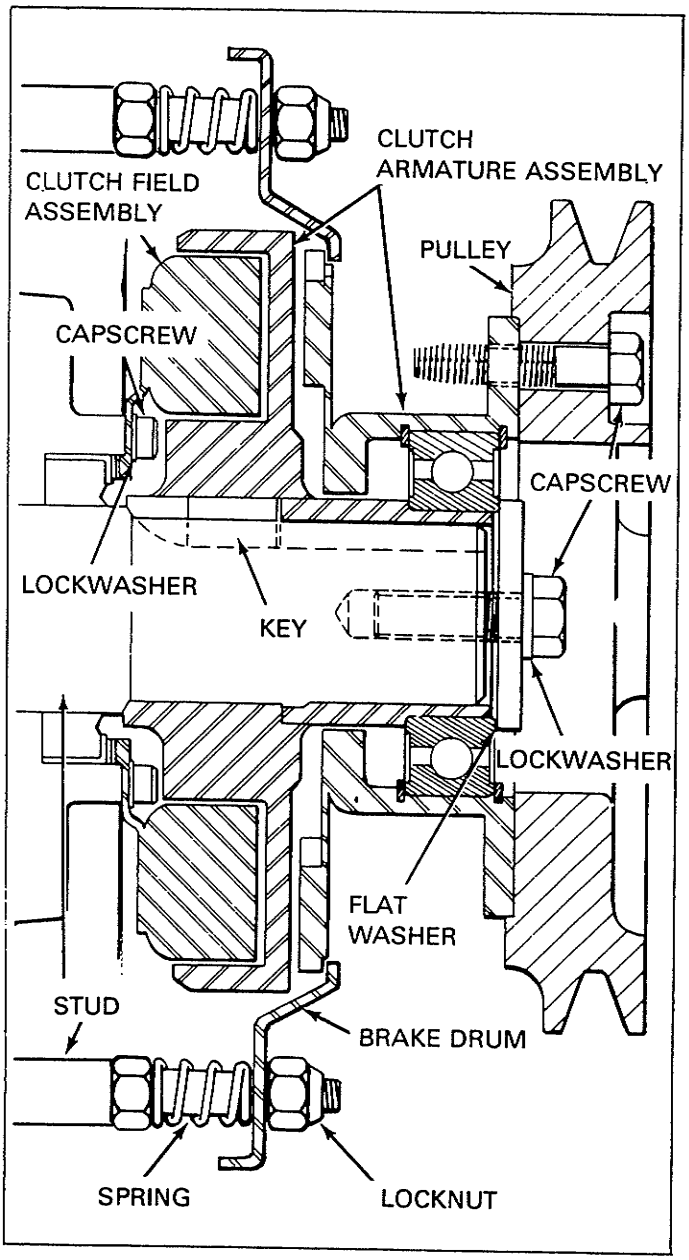


Figure 89. Front PTO Installation

4. On 9020 tractors with Manufacturing No. 1690230 or 1690283, install the clutch brake drum assembly and springs on the four mounting studs and secure with the four nuts.
5. Secure the clutch pulley to the clutch armature assembly with the four 5/16-18 x 1-1/2 inch long capscrews.
6. Connect the clutch field assembly wire to the switch. Make sure the connection is secure and will not rub against the rotating parts.
7. On 9020 tractors with Manufacturing No. 1690230 or 1690283, adjust the clutch brake drum assembly by inserting a 0.010 of an inch feeler gauge through each of the openings in the clutch plate. Do not insert the feeler gauge more than a 1/16 of an inch. If the feeler gauge cannot be inserted at least 1/16 of an inch, turn the four mounting nuts counterclockwise 1/2 of a turn and repeat the check.
8. If a front attachment is mounted to the tractor, install the drive belt on the clutch pulley.

Circuit Breaker Removal and Installation

To remove or install the 20 ampere circuit breaker at the lower right side of the engine, disconnect or connect it from the two yellow wires. Be sure the side marked "Battery" is connected to the wire leading to the solenoid.

Fuse Removal and Installation

On some models, a 30 ampere fuse is provided in the wiring between the ammeter and voltage regulator. It is located at the lower right side of the engine. Remove it from or install it in the fuse holder connected to the black/white and black wires.

Transmission Neutral Start Switch Removal and Installation

To remove the neutral start safety switch on 4040, 4041 Pow'r Max, and 9020 tractors with Manufacturing No. 1690072, use the following procedure (Figure 81).

1. Disconnect the battery.
2. Remove the cover plate and the hole plug from the right side of the tractor frame.
3. Disconnect the neutral start safety switch.
4. Remove the nut securing the switch to the mounting bracket and remove the switch.

To install the neutral start safety switch, use the following procedure.

1. Secure the neutral start safety switch to its mounting bracket on the hydrostatic unit with the mounting nut.
2. Connect the wiring harness to the safety switch.
3. Connect the battery.
4. Adjust the switch following the procedure outlined under Transmission Neutral Start Switch Adjustment.
5. Install the cover plate assembly and hole plug.

To remove the neutral start safety switch on 9020 tractors with Manufacturing No. 1690230 or 1690283, use the following procedure (Figure 82).

1. Disconnect the battery.
2. Remove the three screws holding the right panel assembly to the body support assembly and remove the panel assembly.
3. Disconnect the neutral start safety switch.
4. Remove the two taptite screws securing the switch to the mounting bracket and remove the switch.

To install the neutral start safety switch, use the following procedure.

1. Secure the neutral start safety switch to its mounting bracket on the right side of the body support assembly with the two taptite screws.
2. Connect the wiring harness to the safety switch.
3. Secure the right panel assembly to the body support assembly with the three screws.
4. Connect the battery.
5. Adjust the switch following the procedure outlined under Transmission Neutral Start Switch Adjustment.

Light Removal and Installation (Figure 90)

1. Remove the lamp male connector from the black wire female connector.
2. Remove the lamp mounting nut, lockwasher, and special washer.
3. Remove the lamp from the guard assembly bracket and special washer from the lamp.
4. Install the lamp in reverse order of removal.

Sending Unit Removal and Installation

To remove or install the transmission temperature sending unit, use the following procedure.

1. Disconnect the battery.
2. Remove the bottom cover.
3. Disconnect the electrical connection from the temperature sending unit.
4. Place a suitable container under the transmission case, and remove the temperature sending unit.
5. Replace or reinstall the temperature sending unit in reverse order of removal.

To remove or install the engine pressure sending unit, use the following procedure.

1. Disconnect the battery.
2. Remove the right front cover from the engine.
3. Remove the electrical connection from the sending unit and unscrew the sending unit from the tee.

NOTE

The plug may be removed from the tee for the installation of a pressure gauge if the sending unit is suspected of malfunctioning.

4. Replace or reinstall the temperature sending unit in reverse order of removal.

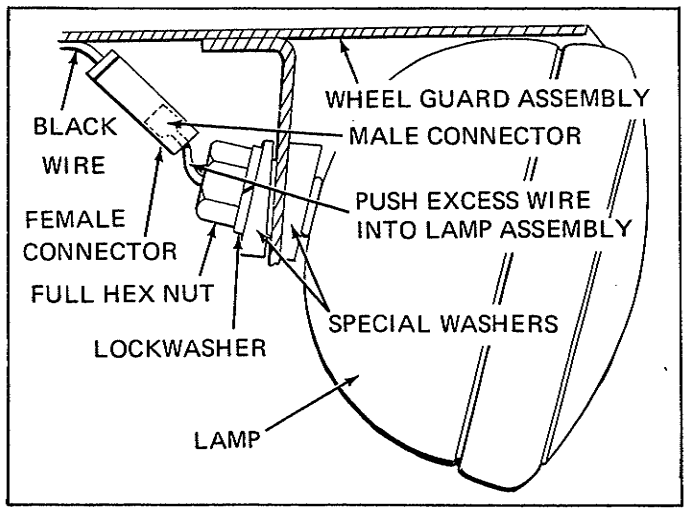


Figure 90. Front Light

TROUBLESHOOTING GUIDE

Symptom	Probable Cause	Remedy
Starter will not crank	Transmission control lever not in NEUTRAL	Position in NEUTRAL
	Either clutch switch not in OFF position.	Position in OFF
	Starting circuit.	See Starting Circuit
	Wiring harness.	See Wiring Harness
Engine turns but will not start.	Out of fuel.	Fill fuel tank
	Engine flooded.	Push choke in and attempt to start
	Crankcase oil too heavy.	Replace oil with grade recommended in Owners Manual
	Fuel filter plugged.	Replace fuel filter
	Water in gasoline.	Remove fuel tank and clean; replace fuel filter
	Ignition circuit.	See Ignition Circuit
Engine starts hard and runs poorly	Fuel mixture too rich.	Push choke in; clean air filter element; set idle needle
	Fuel mixture too lean.	Set idle needle
	Ignition circuit.	See Ignition Circuit
Alternator does not charge or charges poorly	Charging circuit.	See Charging Circuit
Lights and/or hourmeter not operating	Lights and hourmeter circuit.	See Lights and Hourmeter Circuit
Transmission oil over-heating (exceeds 225 degrees F) and warning light not illuminating	Sending unit circuit.	See Pressure and Temperature Unit Circuit
Engine oil pressure low and warning light not illuminating.	Sending unit circuit.	See Pressure and Temperature Unit Circuit
Power take-off clutch inoperative.	Power take-off circuit.	See PTO Circuit

SPECIFICATIONS - 9020 Tractor

Timing	20 BTC (Before top center)
Rectifier-Regulator	13.4-14.7 vdc at 1800-3600 rpm Separate Units
Battery	45 ampere sealed terminals
Alternator	20 ampere
Circuit Breaker	20 ampere
Lights	12 volt sealed beam
Power Take-off Clutch (front or rear)	12 volt electric
Resistance	2.88 ohms
Current	4.17 amperes
Air gap	0.025-0.080 of an inch
Drive (front)	6-1/2 inch A section pulley
Drive (rear)	1-inch internal 15 tooth involute spline
Engine	19.5 H.P. Onan, Model CCKB-MS/2420

FUEL SYSTEM

Description (Figure 91)

The fuel system consists of a fuel tank and fuel gauge, lines, filter, pump, carburetor, air cleaner, governor system, intake manifold, exhaust pipes, and muffler.

System Operation

Fuel is pumped through the fuel filter to the carburetor, and air enters through the air cleaner where dirt and abrasive materials are removed. The clean fuel and air are metered into the engine to meet the changing demands of load and speed. The governor system controls the carburetor throttle to admit a greater or lesser amount of fuel-air mixture. This supports the operator's demand for engine speed and provides power, up to the capacity of the engine, to maintain that speed.

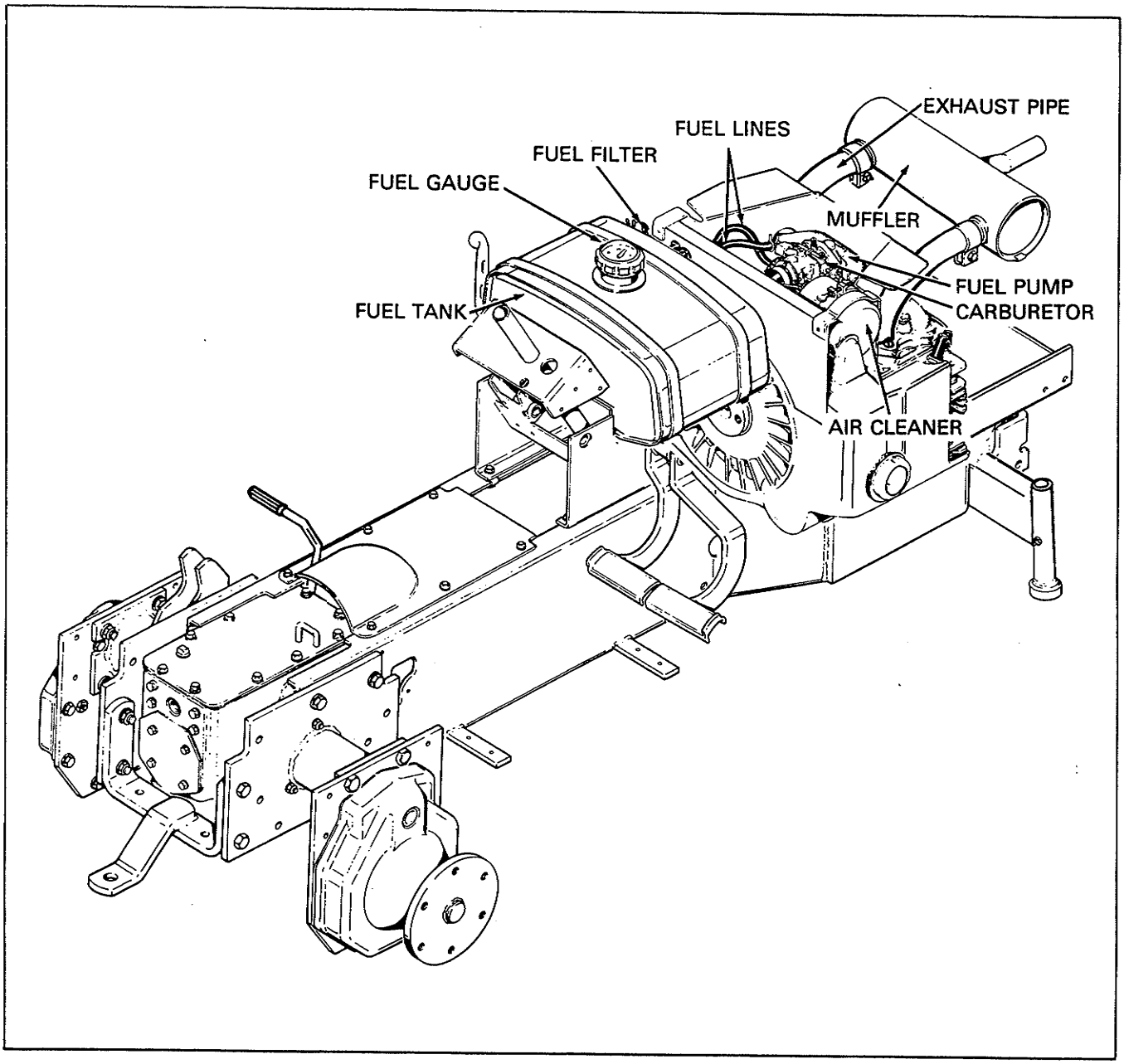


Figure 91. Fuel System (4041, Pow'r Max. 9020)

Fuel Tank and Fuel Gauge Removal, Inspection, and Installation (Figures 92 and 93)

1. Remove the fuel tank and fuel gauge.
   a. Remove the fuel gauge (18) from the tank, and empty the fuel into a suitable container.
   b. Remove the steering wheel and its rubber washer by removing the 5/16-18 x 1-1/4 inch long capscrew and locknut securing them to the steering shaft.
   c. Remove the six screws attaching the instrument panel assembly to the body assembly support. Carefully lift the panel up and over the steering shaft using caution not to disconnect or break the instrument wire connections.
   d. Remove the four taptite screws (20) securing the fuel tank mounting straps (16, 19).

NOTE

Plug the fuel lines to prevent dirt from entering the system.

   e. Disconnect the rubber fuel lines at the fuel tank.
   f. Remove the fuel tank from the tractor carefully without tilting.
2. Inspect, clean and replace the fuel tank and fuel gauge.
   a. Inspect the fuel tank for possible leaks or damage. If the fuel tank is damaged, do not attempt to repair it; replace it with a new tank.
   b. Check the end of the fuel line in the tank. The line must be 1/4 of an inch off the bottom of the tank, or dirt will be sucked into the line and block the flow to the engine. Use a screwdriver or similar tool to bend the line as required.
   c. The float on the fuel gauge may stick and give a false reading on the gauge. Free and clean the float. If the gauge or float are damaged, replace the fuel gauge.
3. Install the fuel tank and fuel gauge.
   a. Install the fuel gauge (18) in the fuel tank.
   b. Place the fuel tank on the felt pads on the tractor. Secure the tank mounting straps (16, 19) with the four taptite screws (20).
   c. Remove the plugs on the fuel lines and install them on the fuel tank nipple connections. Use a pliers to move the clamps (21) over the raised portion on the nipples.
   d. Install the instrument panel assembly on the body assembly support using the six mounting screws.
   e. Install the rubber washer and steering wheel on the steering shaft. Secure the wheel to the shaft using the 5/16-18 x 1-1/4 inch long capscrew and locknut.
   f. Remove the fuel gauge and fill the tank with approximately 3.8 gallons of regular grade gasoline. Replace the fuel gauge.

Air Cleaner Removal, Cleaning, and Installation

The following procedures apply to the 4040 tractor (Figure 92).

1. Remove and disassemble the air cleaner.
   a. Remove crankcase breather tube (11) from the crankcase breather. Loosen the clampscrew (36) securing the air cleaner assembly to the carburetor and remove the assembly from the carburetor. Be careful not to allow dirt or foreign matter to drop down into the carburetor.

NOTE

Air cleaner element (30) may be removed separately by pressing the seal's (29) rubber lips down and by lifting the cleaner element upward.

   b. Remove the air cleaner seal (29) from the cleaner element (30). Remove the O-ring (28) air cleaner (30), and breather tube (11) from the funnel assembly (33).
2. Inspect, clean, and replace air cleaner components.
   a. Replace the air cleaner element if it is unusually dirty. If it is relatively clean, turn the element upside down and tap it lightly.
   b. Check the condition of the rubber seal and breather tube. Replace either if they are hard or cracked.
   c. Replace the O-ring.

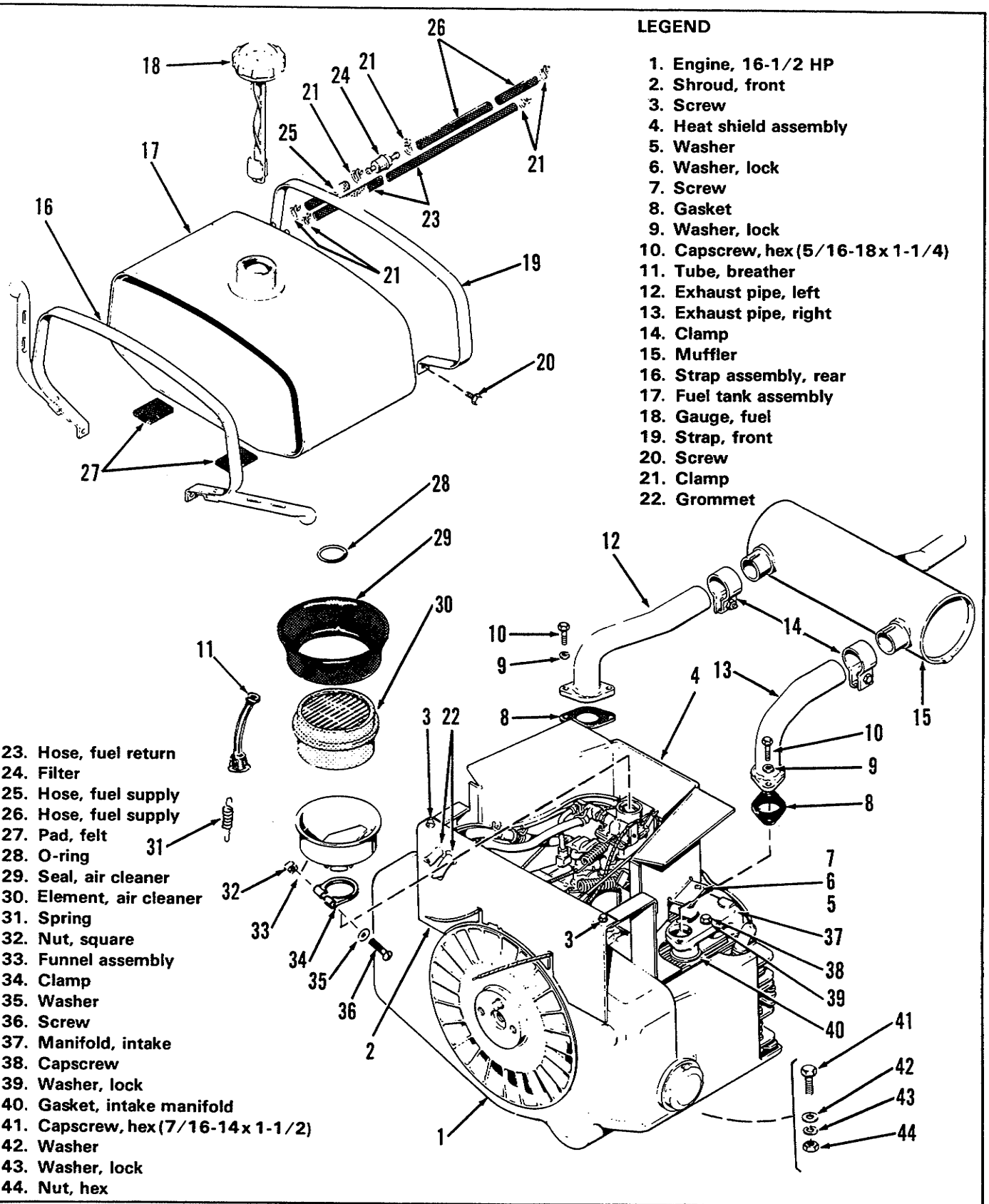


Figure 92. Fuel System Components (4040)

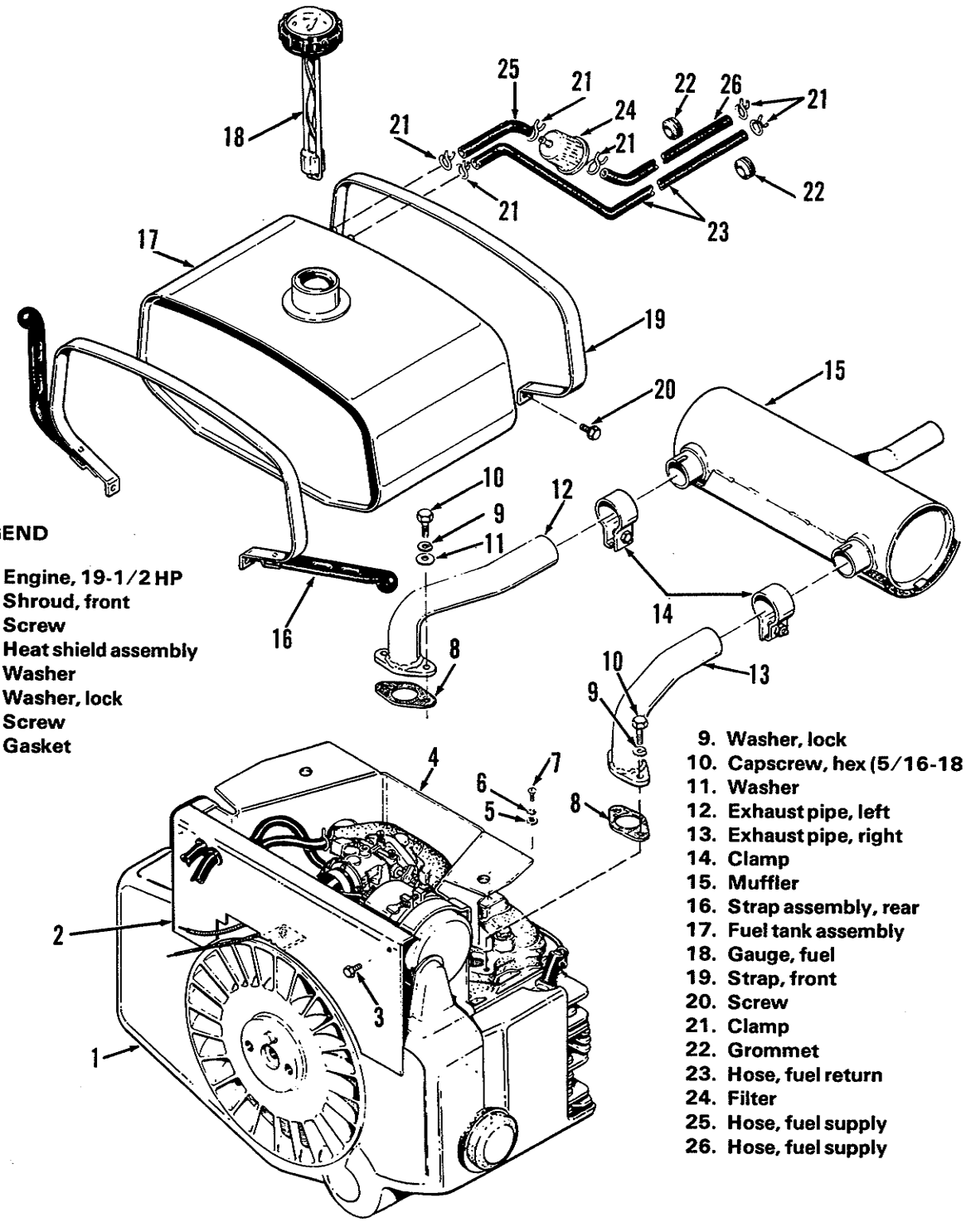


Figure 93. Fuel System Components (4041, Pow'r Max. 9020)

3. Assemble and install the air cleaner.
   a. Replace the breather tube (11) in the funnel assembly as shown in Figure 94. Replace the cleaner element (30) in the funnel assembly. Make sure it is properly seated.

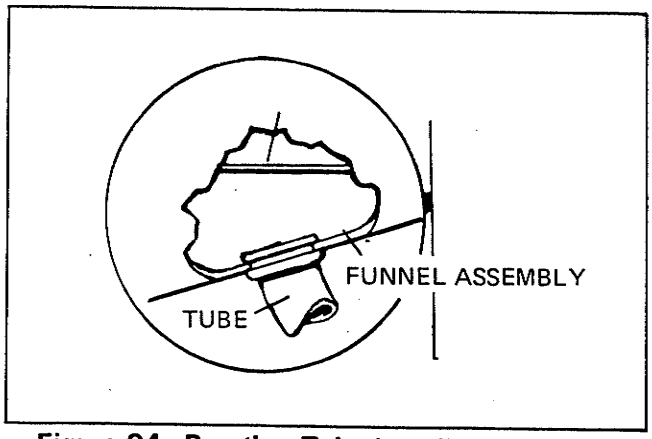


Figure 94. Breather Tube Installation (4040)

   b. Install a new O-ring (28) in the funnel assembly as shown in Figure 95. Install the air cleaner seal (29) on the cleaner element. Make sure the rubber seal fits tightly around the element.
   c. Install the air cleaner assembly on the carburetor and secure it by tightening the clamp screw (36). Install the breather tube (11) on the crankcase breather.

The following procedures apply to the 4041, Pow'r Max, and 9020 tractor (Figure 93).

1. Loosen the air cleaner thumb screw and carefully slide the air cleaner cover from the bowl. Remove the air filter element.

⚠ CAUTION

Never operate the engine without the air filter sealed in place.

2. Clean the air filter element with compressed air or mild detergent and warm water.

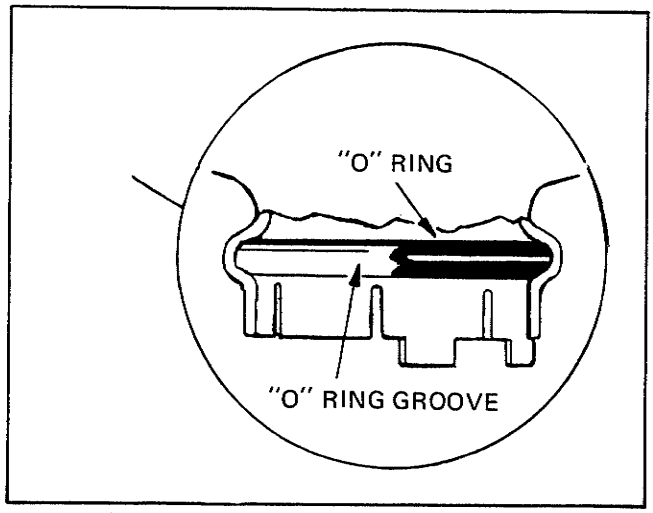


Figure 95. Air Cleaner O-ring Installation (4040)

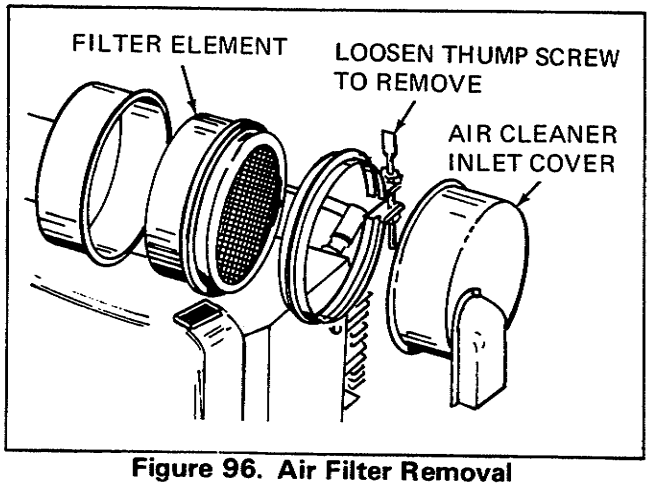


Figure 96. Air Filter Removal (4041, Pow'r Max. 9020)

3. Install the filter element as directed by the arrow on the element. Install the cover and secure the bowl with the clamp. Tighten the air cleaner thumb screw finger tight.

Fuel Lines and Filter (Figures 92 and 93)

Upon demand, fuel is drawn from the fuel tank, through the intake hoses (25 and 26) and fuel filter (24), and into the carburetor inlet. Excess fuel from the carburetor is returned to the fuel tank through the fuel return line (23).

⚠WARNING

Do not remove the fuel lines from the fuel filter when the engine is hot.

To remove or install the fuel lines and fuel filter, a pliers can be used to open and close the spring clamps (21).

The fuel filter must be replaced every 200 hours or more often in dusty and/or hot weather operating conditions. Replace the fuel lines when either are damaged, or when the rubber becomes hard or cracked.

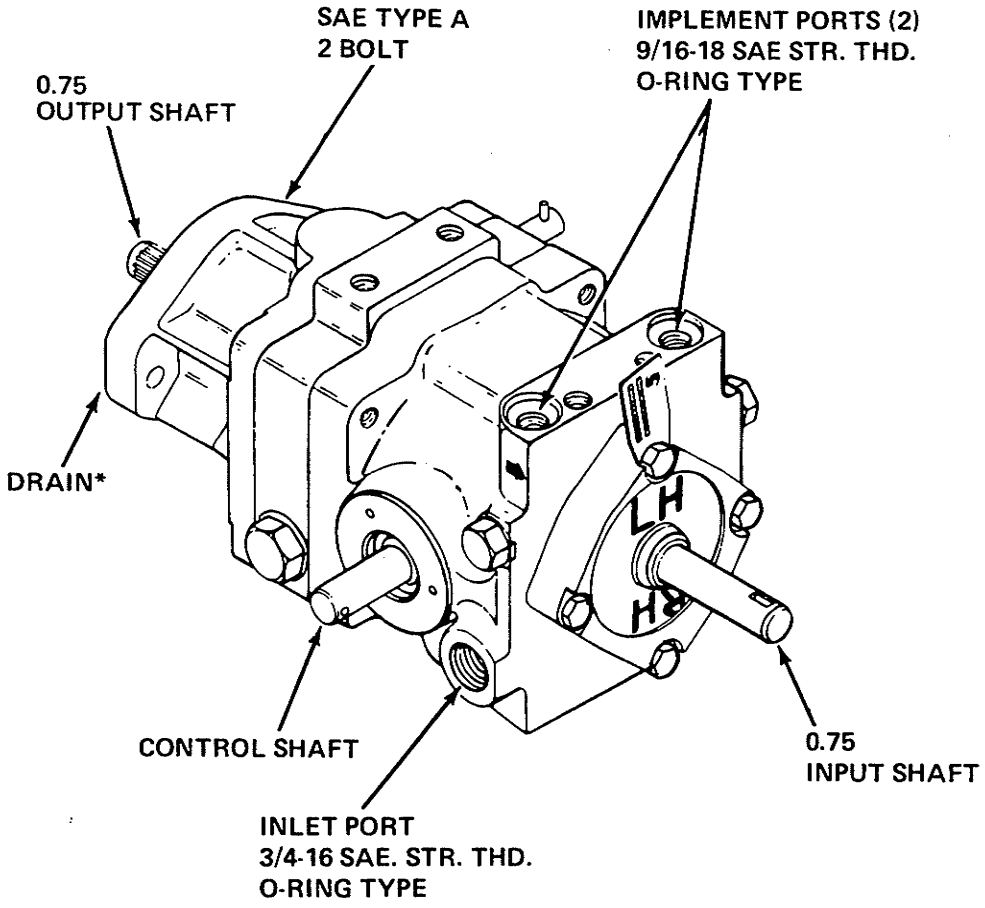
Fuel Pump, Carburetor, Governor, Muffler, etc.

Refer to appropriate Onan repair manual.

IN-LINE HYDROSTATIC UNIT

SPECIFICATIONS

PUMP DISPLACEMENT:	0-.913 in ^{3}/rev.
PUMP INPUT SPEED:	4000 RPM max.
MOTOR DISPLACEMENT:	.913 in ^{3}/rev.
MOTOR OUTPUT SPEED:	0-4000 RPM
MAX. OPERATING PRESSURE:	3000 PSI
CHARGE PUMP DISPLACEMENT:	.33 in ^{3}/rev.
CHARGE RELIEF SETTING:	50-150 PSI
IMPLEMENT RELIEF SETTING:	550-800 PSI
FILTRATION:	25 micron (nominal)



* CASE MUST DRAIN DIRECTLY INTO OUTPUT AXLE OR GEARBOX BEARING

Figure 97. Specifications

HYDRAULIC FLUID RECOMMENDATIONS

Use Type A,F, or Dexron automatic transmission fluid.

SYSTEM DESCRIPTION

Pump/Motor

The 15 Series hydrostatic transmission consists of a variable displacement axial piston pump connected in a closed loop to a fixed displacement axial/ piston motor. The variable displacement pump is driven by the engine. The fixed motor, which is driven by the fluid from the pump, drives the tractor. The direction of rotation and speed of the fixed motor output shaft depends on the flow from the pump, and the system pressure is determined by the machine load. See Figure 98.

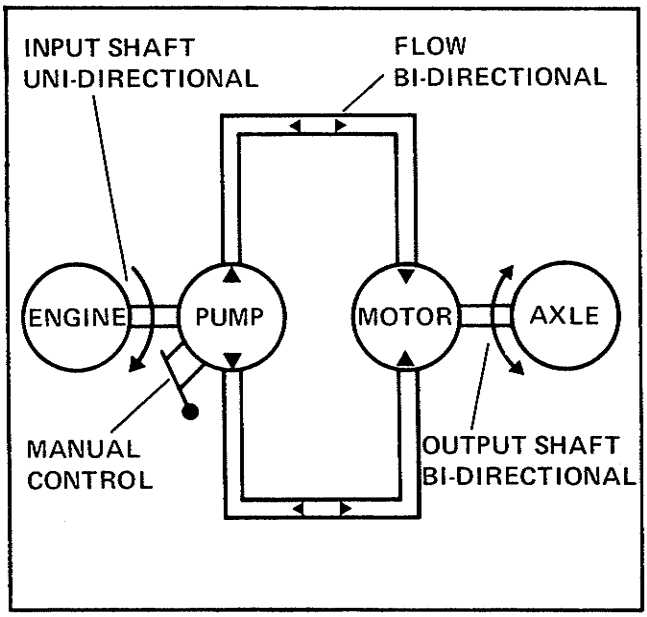


Figure 98. Pump/Motor

Charge Pump and Check Valves

The Axial piston pump and motor have a small amount of internal leakage which is removed from the Pump/Motor closed loop. This results in a fluid loss from that circuit which must be replenished. To accomplish this task, a fixed displacement pump (gerotor type) is used. It is driven directly by the engine through the variable displacement pump shaft. This Charge-Pump provides a predetermined amount of fluid that is used by the Pump/Motor circuit as required to replenish leakage losses. See Figure 99.

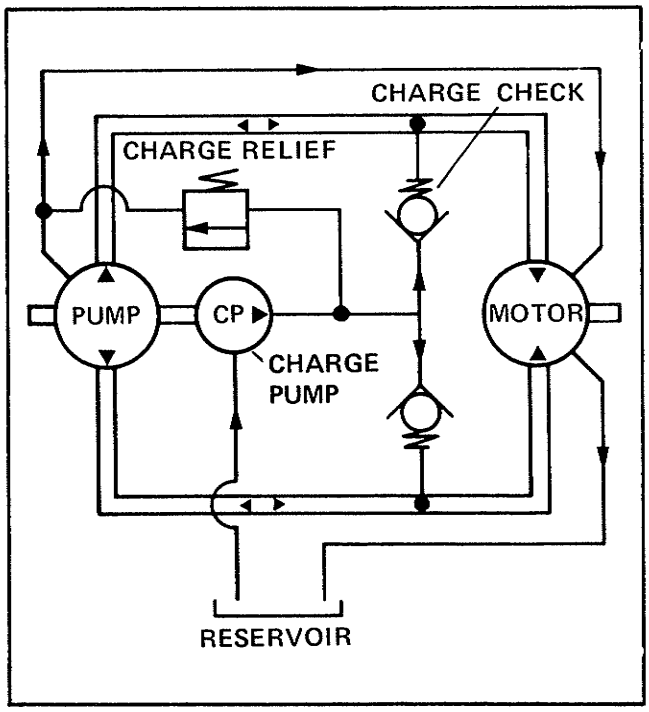


Figure 99. Charge Pump and Check Valves

Since the Pump/Motor circuit is a closed loop, and either side can be pressurized, two directional control check valves are needed to direct Charge Pump flow into the low pressure side of the circuit.

The pressure in this Charge Pump circuit is limited by a factory set, direct operating relief valve. Any fluid not being used is discharged from the circuit over this valve and passes through the pump and motor housings and back to the system reservoir.

Control

The speed at which the output shaft turns depends on the position of the control lever and is infinitely variable between zero and maximum speed. The direction of rotation of the output shaft depends on the position of the control lever in relation to the neutral position.

The variable displacement pump has a manual control lever connected directly to the tiltable swashplate, so that as the operator moves the control, the swashplate tilts resulting in fluid flow from the pump. The fluid enters the fixed displacement motor and pressure increases until the motor (output) shaft begins to rotate. See Figure 100.

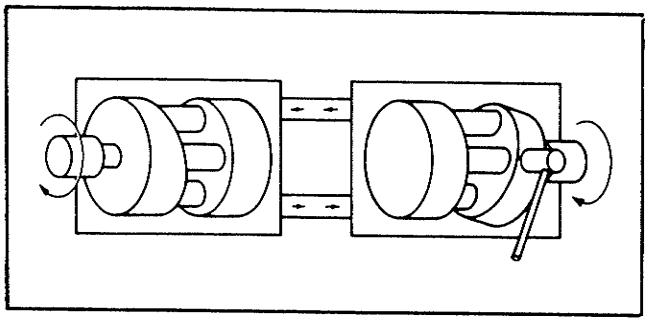


Figure 100. Forward

When the swashplate is at neutral (zero tilt angle) there is no stroking of the internal axial pistons and therefore, no flow from the pump to the motor. See Figure 101.

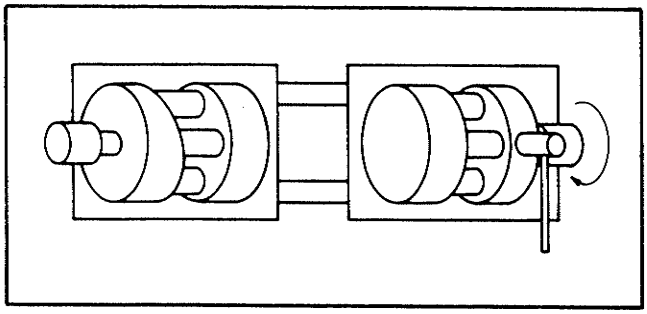


Figure 101. Neutral

The direction of motor (output) shaft rotation depends upon which port the fluid enters. Reversing the direction that the swashplate is tilted from neutral (zero angle) reverses the output shaft rotation hence the direction of the tractor. See Figure 102.

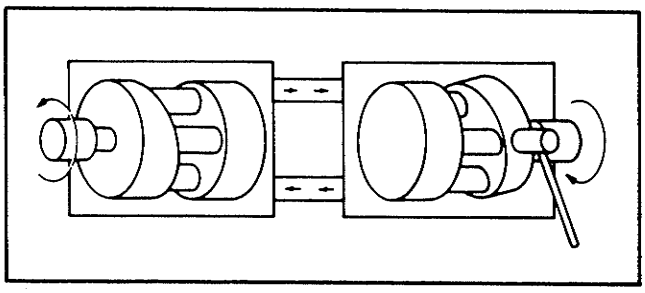


Figure 102. Reverse

Implement Relief Valve

An Implement relief valve is added to the transmission circuit which allows intermittent operation of the Charge Pump at higher pressure (up to 800 PSI). The Implement Circuit must be of the "Open Center" type so that when not in operation the excess Charge Pump flow spills across the Charge Relief Valve, which is set at normal Charge pressure, through the Implement Circuit and into the pump housing. When the Implement Circuit is being operated the charge pressure can build up to the higher setting of the Implement Relief Valve. See Figure 103.

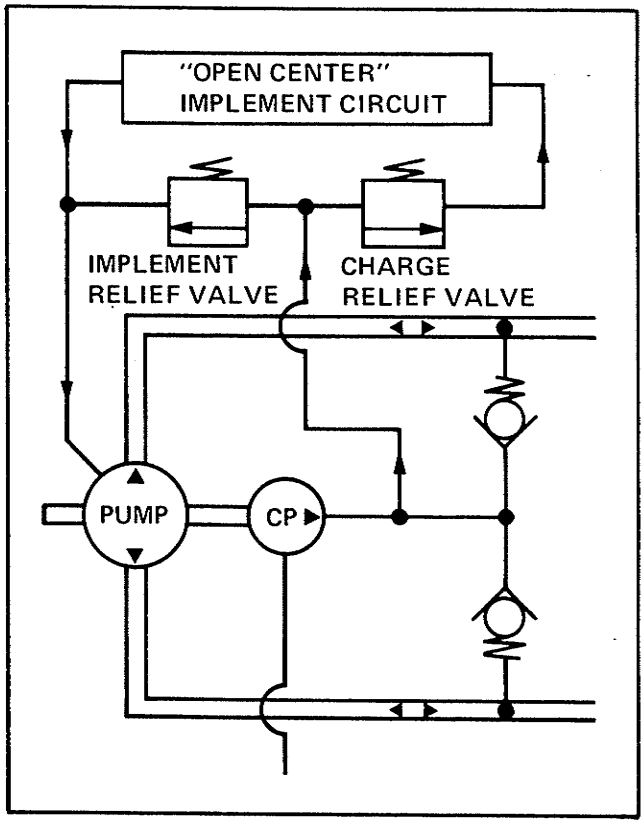


Figure 103. Implement Relief Valve

Acceleration Valves

One of the characteristics of a closed loop system is its instantaneous response to control input signals.

Acceleration control valves are added to give a desirable machine response rate. These valves consist of spring loaded spools that by-pass some of the pump flow around the fixed motor so maximum flow does not reach the motor instantly even though a maximum command has been given. These valves close at a predetermined rate as system pressure increases giving a safe response rate. See Figure 104.

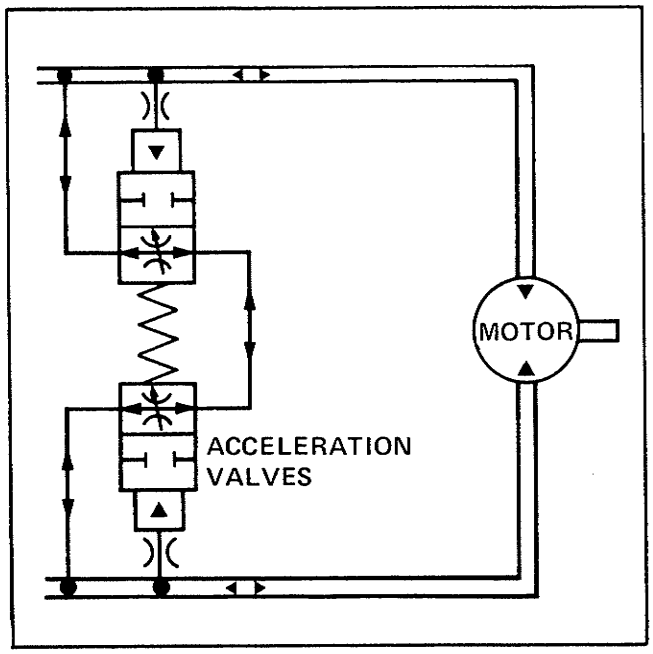


Figure 104. Acceleration Valves

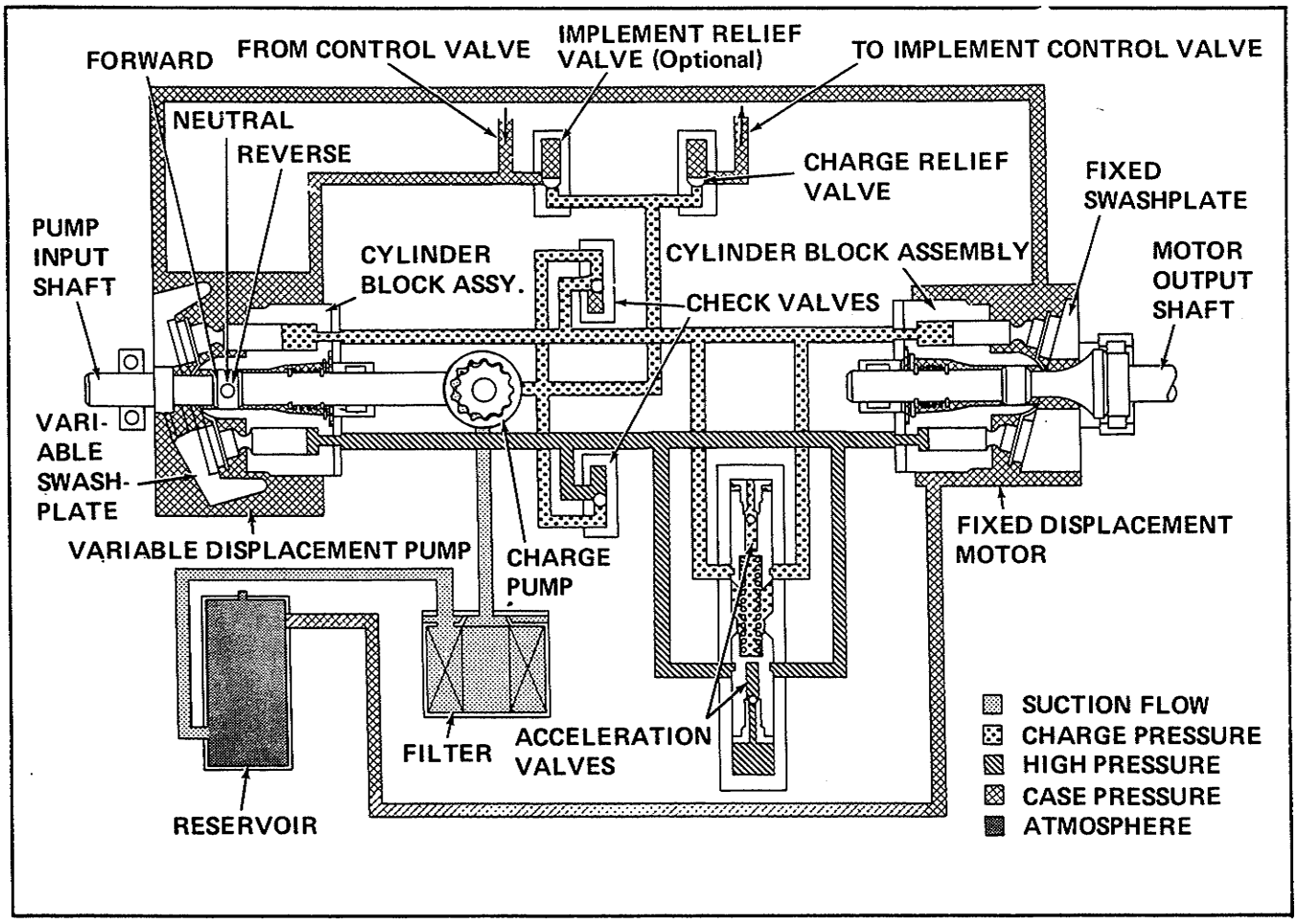


Figure 106. Circuit Flow Diagram

Testing

GENERAL

Testing the inline hydrostatic unit in the Simplicity tractor is limited to checking the Charge Relief pressure and the Implement Relief pressure. Both are checked at the Charge Relief Port on top of the pump housing using a 0-1000 PSI pressure gauge.

⚠ CAUTION

Always use a snubber or needle valve between port and gauge to dampen pulsations.

If either pressure is low, follow the checks given in the Troubleshooting section of this manual to determine cause.

TEST PROCEDURE

1. Make certain tractor engine is off.
2. Remove charge relief valve pipe plug from top of pump housing as shown in Figure 107.
3. Attach pressure gauge and snubber to Charge Relief Port with a short piece of tubing as shown in Figure 108.
4. Operate tractor engine at close to full speed with Implement Control Lever up (off). Gauge will now be showing Charge Relief pressure. Reading should be 70-150 PSI.
5. Pull implement lever down (on). Gauge will now show Implement Relief pressure. Reading should be 700-800 PSI.
6. If either pressure is low, follow the checks given in the Troubleshooting section of this manual to determine cause.

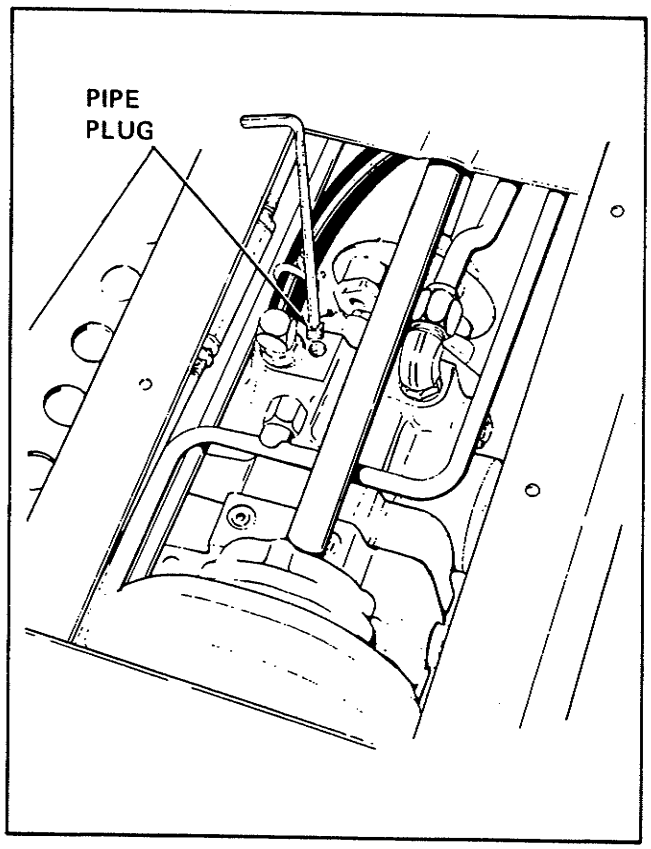


Figure 107. Removing Pipe Plug

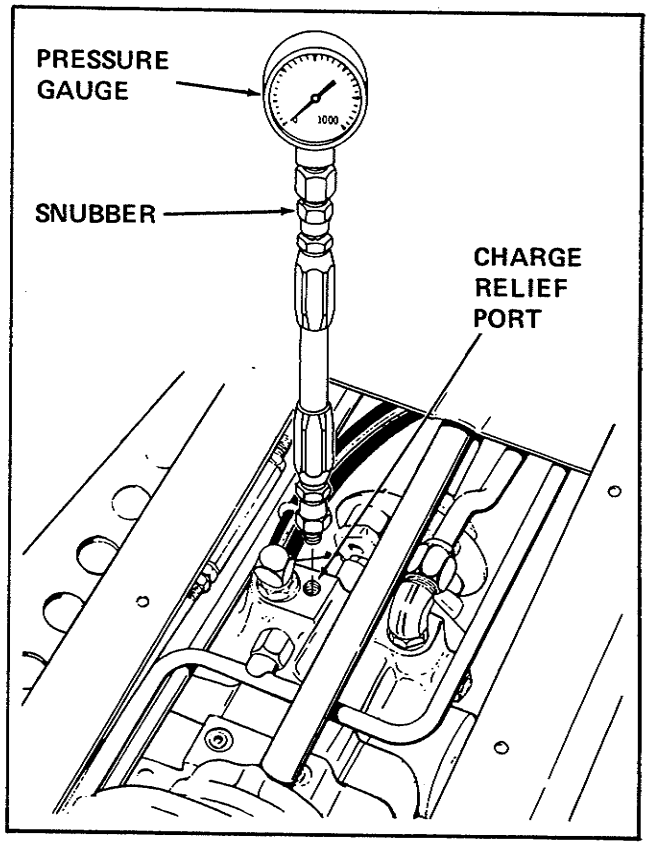


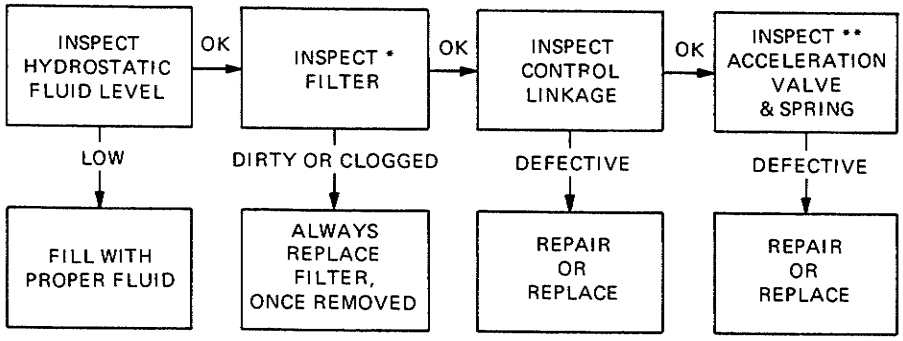
Figure 108. Testing Charge Relief and Implement Relief Pressures

Troubleshooting

NOTE

Always check all other possible causes of malfunctions listed in the appropriate tractor service manual before troubleshooting the hydrostatic unit.

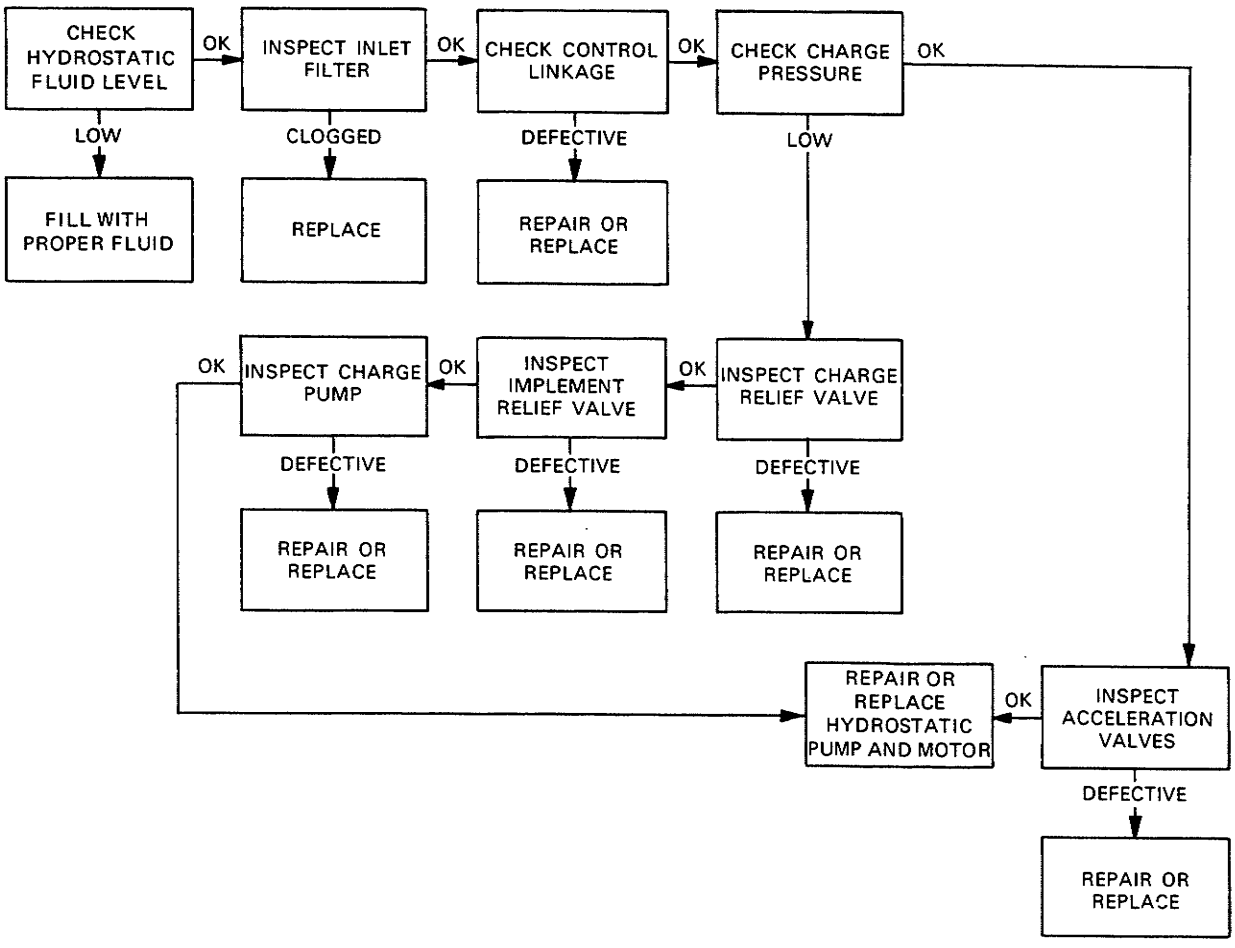
SYSTEM JERKY WHEN STARTING OR OPERATES IN ONE DIRECTION ONLY



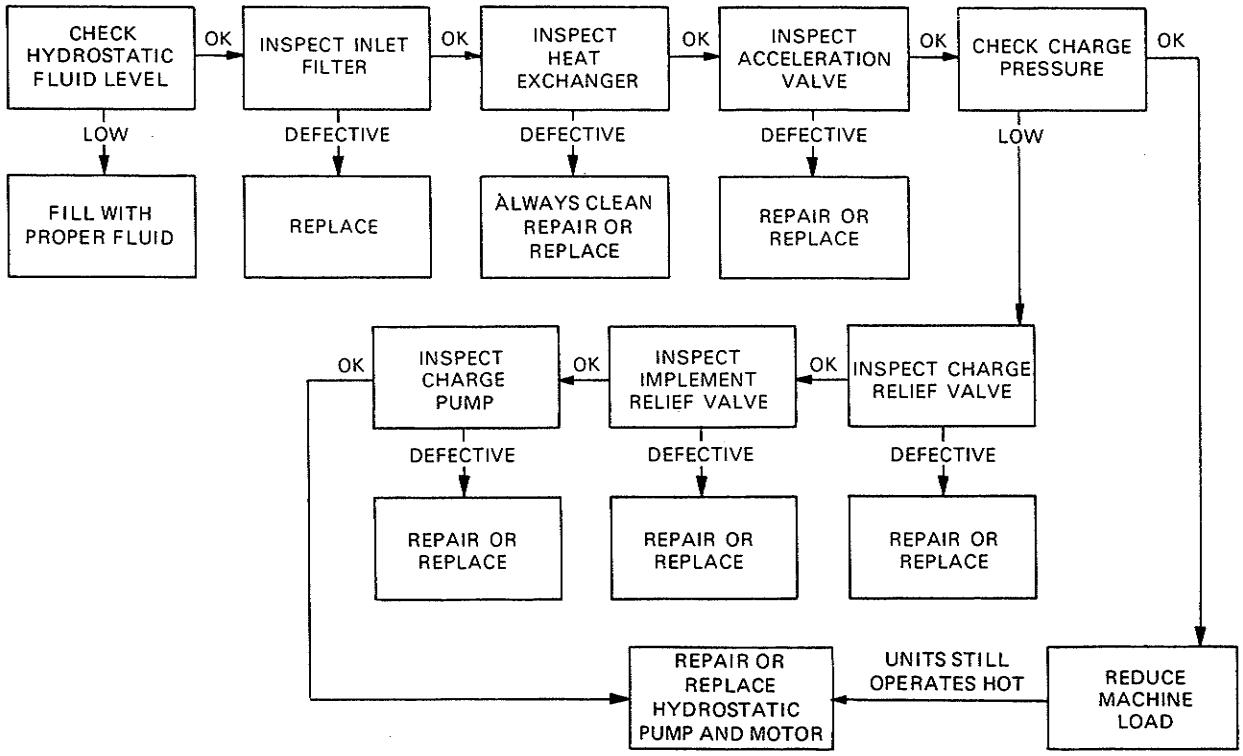
* If metal particles are found, disassemble and inspect entire hydrostatic unit.

** Only one valve can be removed and inspected without removing unit from tractor.

LOSS OF POWER OR SYSTEM WILL NOT OPERATE IN EITHER DIRECTION



SYSTEM OPERATING HOT



Removal and Installation

GENERAL

Cleanliness is the primary means of insuring satisfactory transmission life. Do not allow ANY particulate (such as dirt or sand) or chemical contaminants (even water) to enter the hydrostatic unit during removal, repair, or installation.

Always thoroughly steam clean the hydrostatic unit before any hoses are disconnected. If steam cleaning is not possible, clean the unit using fuel oil or a suitable solvent.

⚠CAUTION

Do not use paint thinner, acetone, or acetone based solvents. These may damage "O" rings, gaskets, or seals.

Check especially that areas around hose fittings, valves, and external shafts are clean and free of dirt and grease.

Do not pound or hammer on input, output or control shafts when installing control linkage or drive coupling (see Figure 109). Driving on these shafts WILL damage the hydrostatic unit.

Always use new hydraulic fluid and filter.

REMOVAL

1. Remove screws attaching top and bottom covers and remove covers.

⚠WARNING

Be certain that rear wheels are blocked.

2. Drain oil from two lower forward points of the transmission. One of these is the transmission temperature sending unit and the other is the filter inlet hose elbow. Remove sending unit wire, and remove sending unit. See Figure 110. Disconnect filter inlet hose from elbow and remove elbow. Be certain oil drains into a proper container. Discard this oil.

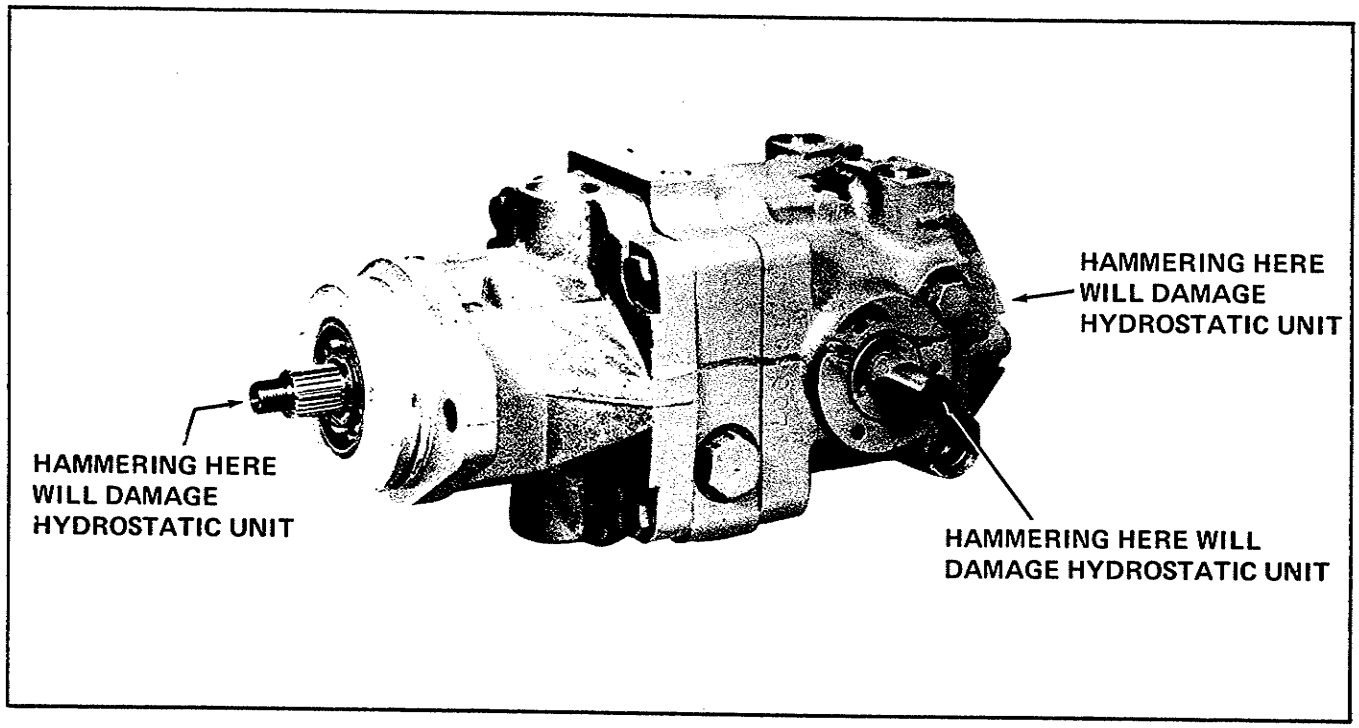


Figure 109. Do Not Drive On Input, Output, or Control Shafts

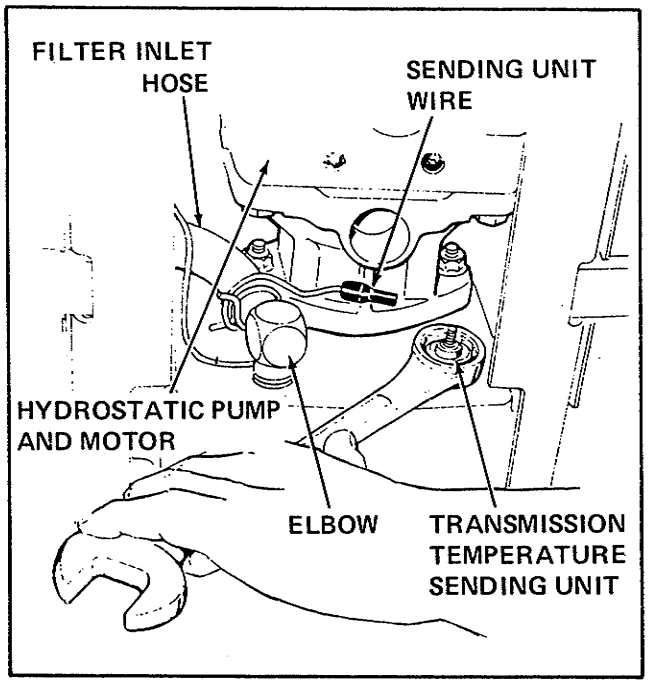


Figure 110. Draining Oil From Transmission

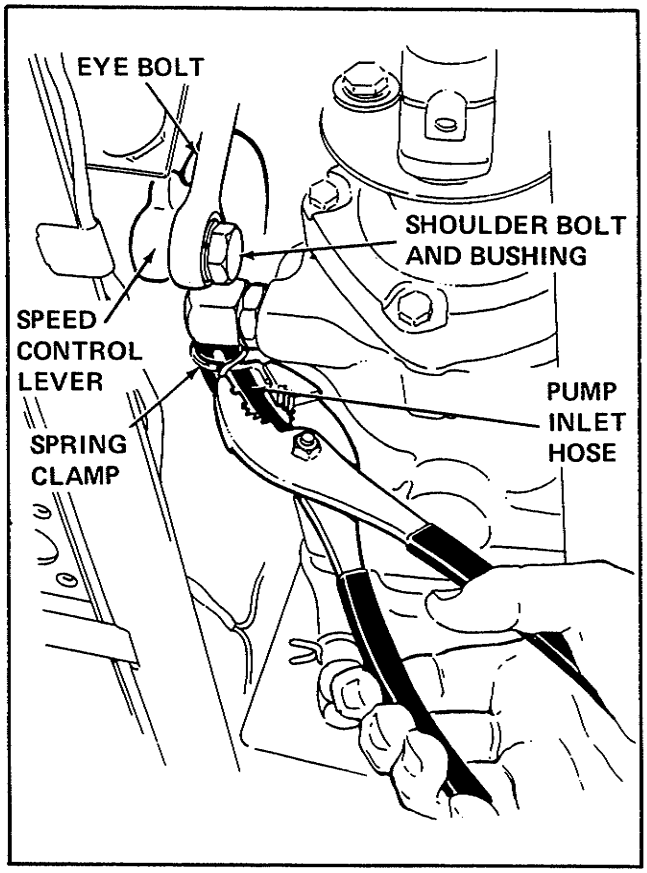


Figure 111. Disconnecting Pump Inlet Hose and Speed Control Lever

3. Remove both flange nuts holding unit to transmission. The left hand nut is made accessible by removing cover on left side of tractor frame.

   To assist you in removing flange nuts, use a thin 9/16" swivel socket and extension.

4. Disconnect pump inlet hose from transmission fitting. See Figure 111. Remove shoulder bolt and bushing which attach eyebolt to speed control lever.

5. Remove the 4 capscrews, lockwashers, and flatwashers which secure two yokes to coupling. Remove coupling and drive shaft yoke. Push end of drive shaft up and out of your way as much as possible.

6. Refer to Figure 112 and working from the bottom, disconnect pressure tube directly below the top drive shaft. This is the tubing between the hydrostatic unit and lift valve. Remove this tube.

⚠CAUTION

Do not rotate tubing; rotate the fitting attaching tube to elbow.

7. Working from the top, rotate elbow (from which tubing was removed) 90 degrees to the left.

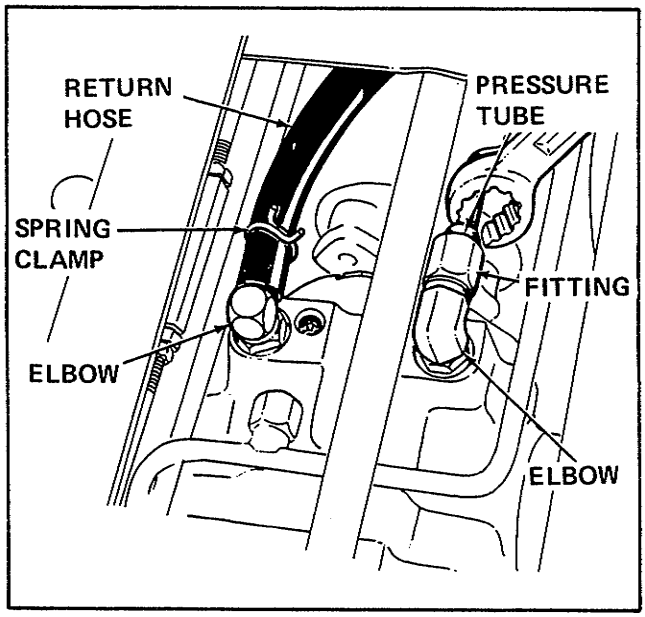


Figure 112. Disconnect Return Hose and Pressure Tube (Shown from Top)

8. Remove spring clamp from return hose (forward on left side of hydrostatic unit). Remove and tie return hose up under dash to prevent fluid from leaking out.
9. Remove safety switch connection at right rear of hydro unit.
10. Work unit free prying from top and bottom. Keep hydro unit in the same plane at which it was installed.
11. When free, rotate complete unit 90° to the left and lower unit out of frame from the bottom.

NOTE

When freeing and removing the hydrostatic unit, a "second set of hands" from the top can simplify and speed-up the task.

INSTALLATION

The bevel gear of the hydrostatic pump must be correctly shimmed in order to properly mesh with the transmission gear.

1. If the old hydrostatic unit is being re-installed, be certain that old shims are saved, cleaned, and replaced.
2. If a new hydrostatic unit is being installed it is necessary to get the four digit number beginning with "30" from the transmission and the three digit number beginning with "9" from the hydrostatic unit. (This is on the new unit.) See Figure 113.

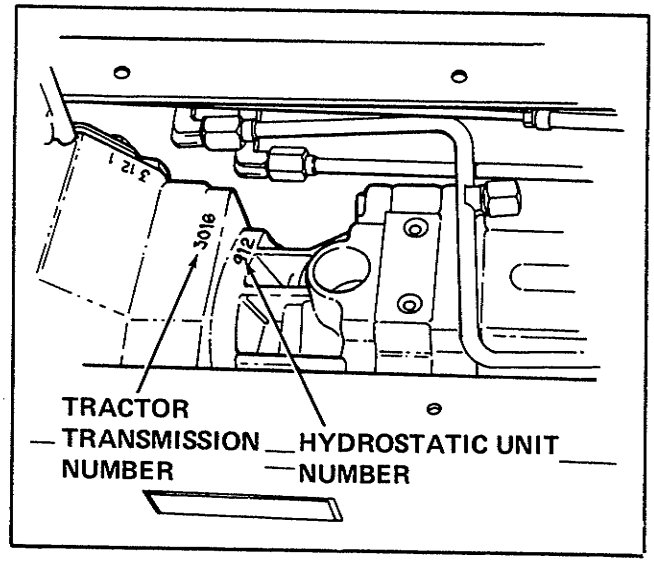


Figure 113. Shim Selection Numbers

3. After these two numbers have been recorded, the required amount of shim can be determined by using the chart, Figure 114. Read across to the correct 9 number and down to the correct 30 number. This will give the proper amount of shim.

   Example: 912 x 3016 requires .042" of shim.
4. All other installation procedures are in reverse order of removal.

HYDROSTATIC PUMP MOTOR (On Motor Housing)

TRANSMISSION NUMBER (On Case)

	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915
3000	.038	.037	.036	.035	.034	.033	.032	.031	.030	.029	.028	.027	.026	.025	.024	.023
3001	.039	.038	.037	.036	.035	.034	.033	.032	.031	.030	.029	.028	.027	.026	.025	.024
3002	.040	.039	.038	.037	.036	.035	.034	.033	.032	.031	.030	.029	.028	.027	.026	.025
3003	.041	.040	.039	.038	.037	.036	.035	.034	.033	.032	.031	.030	.029	.028	.027	.026
3004	.042	.041	.040	.039	.038	.037	.036	.035	.034	.033	.032	.031	.030	.029	.028	.027
3005	.043	.042	.041	.040	.039	.038	.037	.036	.035	.034	.033	.032	.031	.030	.029	.028
3006	.044	.043	.042	.041	.040	.039	.038	.037	.036	.035	.034	.033	.032	.031	.030	.029
3007	.045	.044	.043	.042	.041	.040	.039	.038	.037	.036	.035	.034	.033	.032	.031	.030
3008	.046	.045	.044	.043	.042	.041	.040	.039	.038	.037	.036	.035	.034	.033	.032	.031
3009	.047	.046	.045	.044	.043	.042	.041	.040	.039	.038	.037	.036	.035	.034	.033	.032
3010	.048	.047	.046	.045	.044	.043	.042	.041	.040	.039	.038	.037	.036	.035	.034	.033
3011	.049	.048	.047	.046	.045	.044	.043	.042	.041	.040	.039	.038	.037	.036	.035	.034
3012	.050	.049	.048	.047	.046	.045	.044	.043	.042	.041	.040	.039	.038	.037	.036	.035
3013	.051	.050	.049	.048	.047	.046	.045	.044	.043	.042	.041	.040	.039	.038	.037	.036
3014	.052	.051	.050	.049	.048	.047	.046	.045	.044	.043	.042	.041	.040	.039	.038	.037
3015	.053	.052	.051	.050	.049	.048	.047	.046	.045	.044	.043	.042	.041	.040	.039	.038
3016	.054	.053	.052	.051	.050	.049	.048	.047	.046	.045	.044	.043	.042	.041	.040	.039
3017	.055	.054	.053	.052	.051	.050	.049	.048	.047	.046	.045	.044	.043	.042	.041	.040
3018	.056	.055	.054	.053	.052	.051	.050	.049	.048	.047	.046	.045	.044	.043	.042	.041
3019	.057	.056	.055	.054	.053	.052	.051	.050	.049	.048	.047	.046	.045	.044	.043	.042
3020	.058	.057	.056	.055	.054	.053	.052	.051	.050	.049	.048	.047	.046	.045	.044	.043
3021	.059	.058	.057	.056	.055	.054	.053	.052	.051	.050	.049	.048	.047	.046	.045	.044
3022	.060	.059	.058	.057	.056	.055	.054	.053	.052	.051	.050	.049	.048	.047	.046	.045
3023	.061	.060	.059	.058	.057	.056	.055	.054	.053	.052	.051	.050	.049	.048	.047	.046
3024	.062	.061	.060	.059	.058	.057	.056	.055	.054	.053	.052	.051	.050	.049	.048	.047

Figure 114. Selecting Proper Amount of Shim

Disassembly, Repair and Reassembly

GENERAL

Clean the hydrostatic unit before disassembly. REMEMBER: CLEANLINESS IS THE PRIMARY MEANS OF INSURING SATISFACTORY TRANSMISSION LIFE.

⚠CAUTION

Do not use paint thinner, acetone, or acetone based solvents. These may damage "O" rings, gaskets, or seals.

The hydrostatic transmission may be considered a sandwich or building block construction, consisting of three (3) distinct assemblies; motor, center, and pump section. See Figure 115.

Prior to disassembly, scribe a mark with a metal tool on the control side covering all three sections plus the charge pump housing. This will verify reassembly and indicate correct side for control trunnion shaft.

Charge Pump

The charge pump with housing must be removed before you start the complete disassembly. Note the orientation of the charge pump housing to adjacent housing and make certain both housings are scribed to insure proper relocation. Clean the shaft extension to remove all sharp edges, burrs and abrasive residue to prevent shaft seal damage.

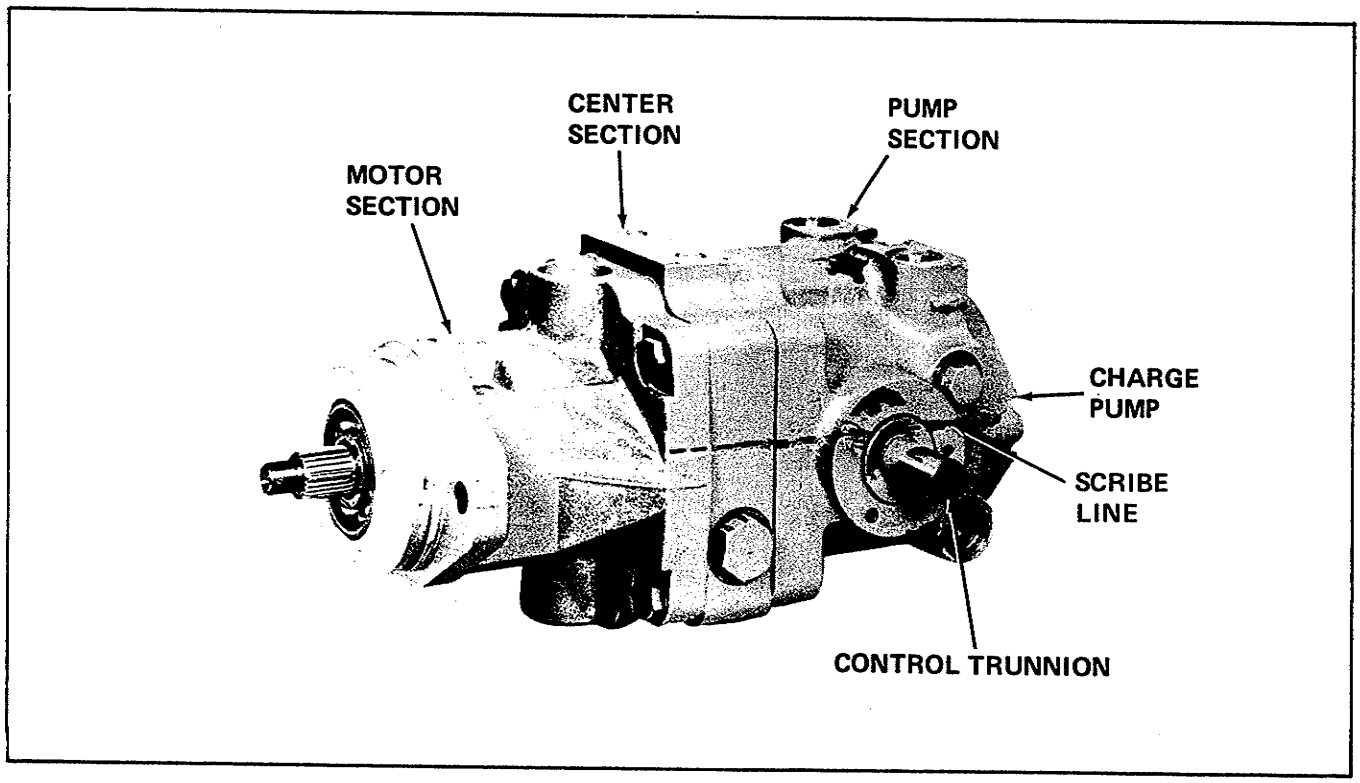


Figure 115. Three Transmission Sections

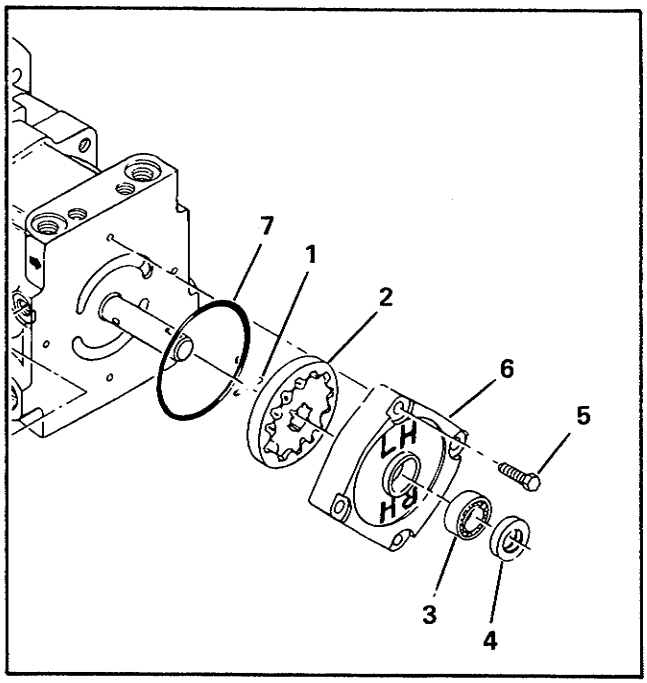


Figure 116. Charge Pump

Remove 4 hex head screws (Figure 116, item 5) and slide the housing assembly, (items 3, 4, 6 and 7) over the shaft. Remove drive pin (item 1) and gerotor assembly (item 2), from shaft. Remove shaft seal and bearing (items 4 and 3) from housing only if replacement is necessary.

Examine the wear surfaces of pump cartridge for excessive scratching or heavy wear patterns. Replace both parts of this cartridge, if necessary. Do not replace or interchange individual parts within the cartridge. The drive pin should always be replaced. Visually inspect bearing (item 3), O-ring (item 7), and shaft seal (item 4) and replace as required. Torque screws 16-21 ft-lbs.

Charge Relief Valve - Right Hand Side (in Tractor)

Remove plug (Figure 117, item 1) then slide the spring (item 2) and ball (item 3) out of the housing. Do not alter the shims (item 4) if used or interchange parts with another valve. Inspect the ball and seat in housing for damage and remove any foreign material in the valve area. Replace parts as required and reinstall into housing bore.

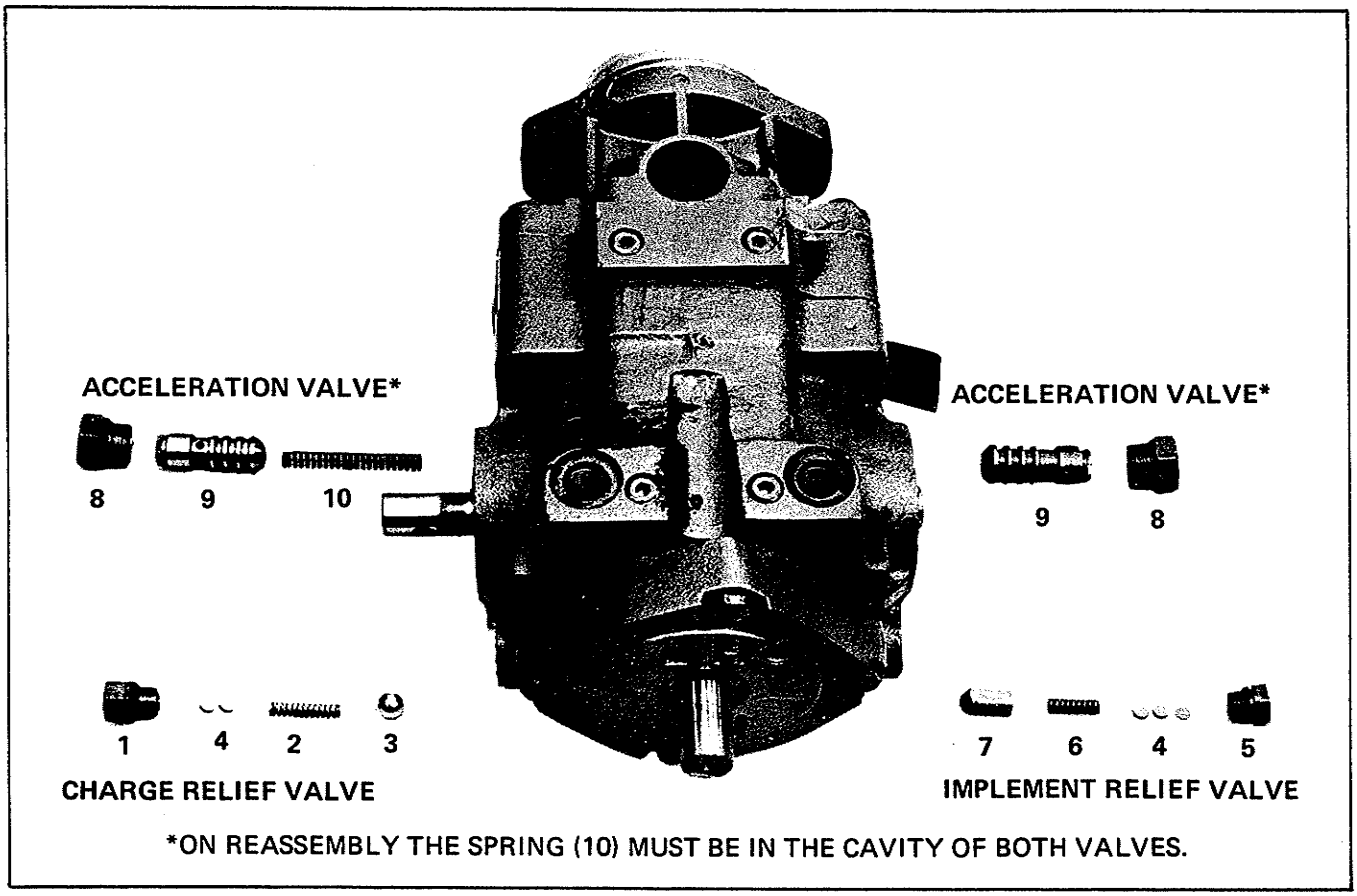


Figure 117. Charge Relief, Implement, and Acceleration Valves

Implement Relief Valve - Left Hand Side (in Tractor)

Remove plug (Figure 117, item 5) then slide the spring (item 6) and poppet (item 7) out of the housing. Do not alter the shims (item 4) if used or interchange parts with another valve. Inspect the poppet and seat in the housing for damage and remove any foreign material in the valve area. Replace parts as required and reinstall into housing bore.

Acceleration Valves

Remove plugs (Figure 117, item 8) from each side of housing and slide out one valve assembly (item 9) and spring (item 10) from one side of the other valve assembly from the other side. Inspect the valves and bores for damage and remove any foreign material in the valve area. Replace parts as required and reinstall into housing.

⚠ CAUTION

Valves are not interchangeable.

NOTE

When reinstalling valves make certain that three or more threads are showing on each side before installing plugs.

Shaft and Trunnion Seals

Lip type seals (Figure 118) are used throughout the transmission. These seals can be replaced without disassembly of the transmission.

Pry the seal carefully out of the housing bore, using care not to distort the housing or damage the bore or shaft. Once removed, the seal is not reusable.

Prior to installing the new seal, polish the shaft extension, wrap it in plastic wrap and lubricate with hydraulic oil to insure that the seal is not damaged during assembly. Slide the seal over the shaft and press it into the housing bore.

In the case of trunnion shaft seals it is necessary that the retaining rings (item 4) and washers (item 5) be removed before removing the seals. The washer should be replaced if it is noticeably bent or distorted.

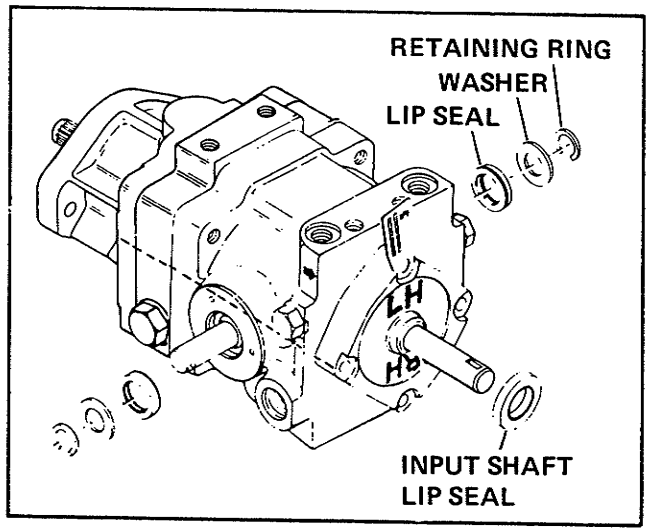


Figure 118. Replacing Seals

MAJOR DISASSEMBLY AND REPAIR

Separating the Three Main Sections

When the 4 hex head screws are loosened, the internal spring loading will cause the unit to separate slightly. Loosen these screws evenly to prevent distortion of parts and do not allow internal parts to fall when separating unit. Fluid trapped internally will spill as the screws are loosened. See Figure 119.

Motor Section

Pull the motor section (end of unit with splined shaft) away from unit (see Figure 119 above). Valve plate tends to remain on center section, remove it and do not allow it to fall when separating this section. Keep the motor valve plate separate from the pump valve plate as they are not interchangeable. Remove the gasket.

Note the orientation of the motor housing to the center section and make certain both are scribed to insure proper relocation.

Lift out the cylinder block assembly (see Figure 120). This is the same for both pump and motor section. The pistons may come out of cylinder block bores. There is no special orientation of piston to bore that needs to be maintained.

Do not attempt to disassemble the spring and other parts from the center bore of the cylinder block. The entire cylinder block assembly should be replaced if any of its components are damaged. Parts are not interchangeable between cylinder block assemblies.

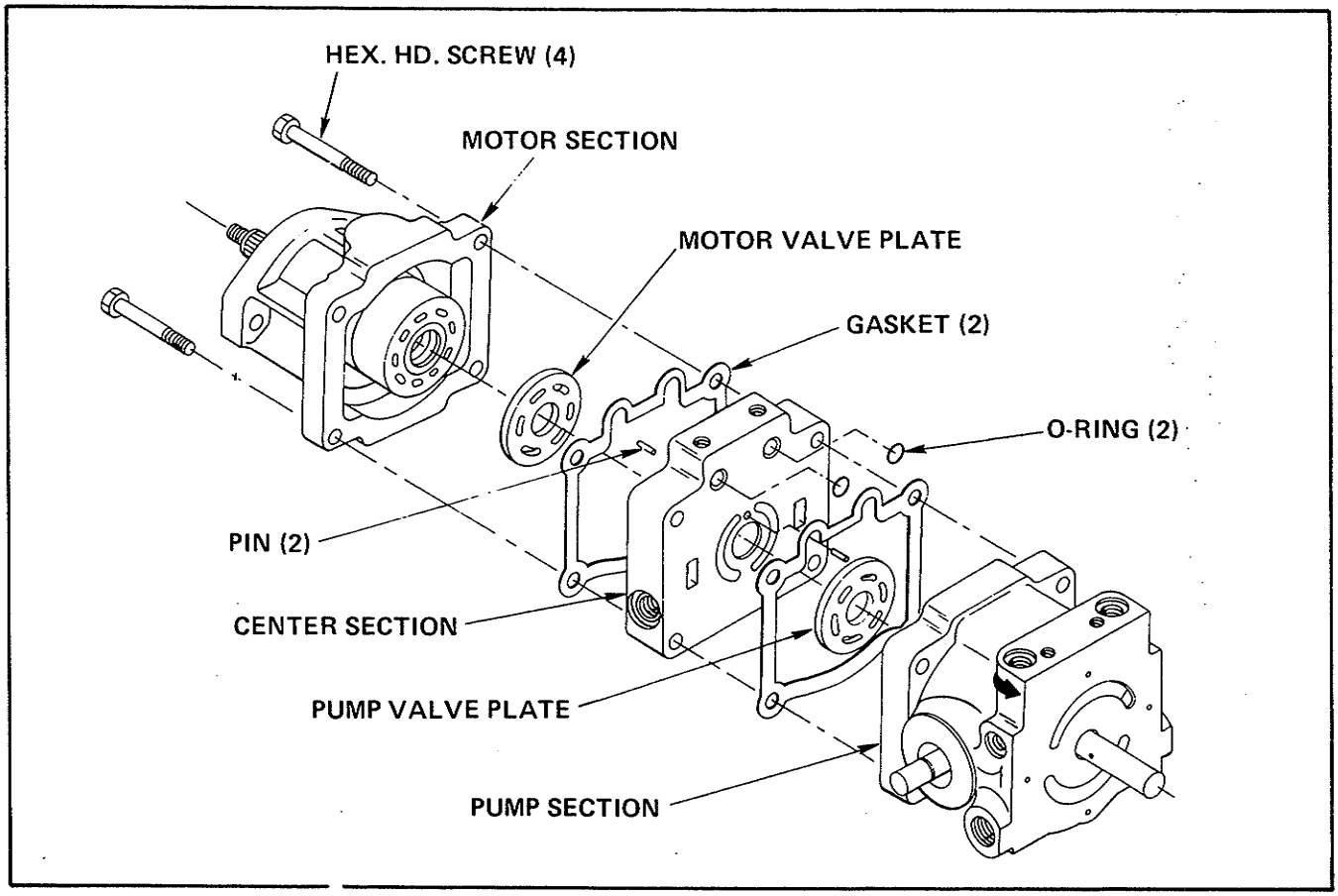


Figure 119. Separating the (3) Main Sections

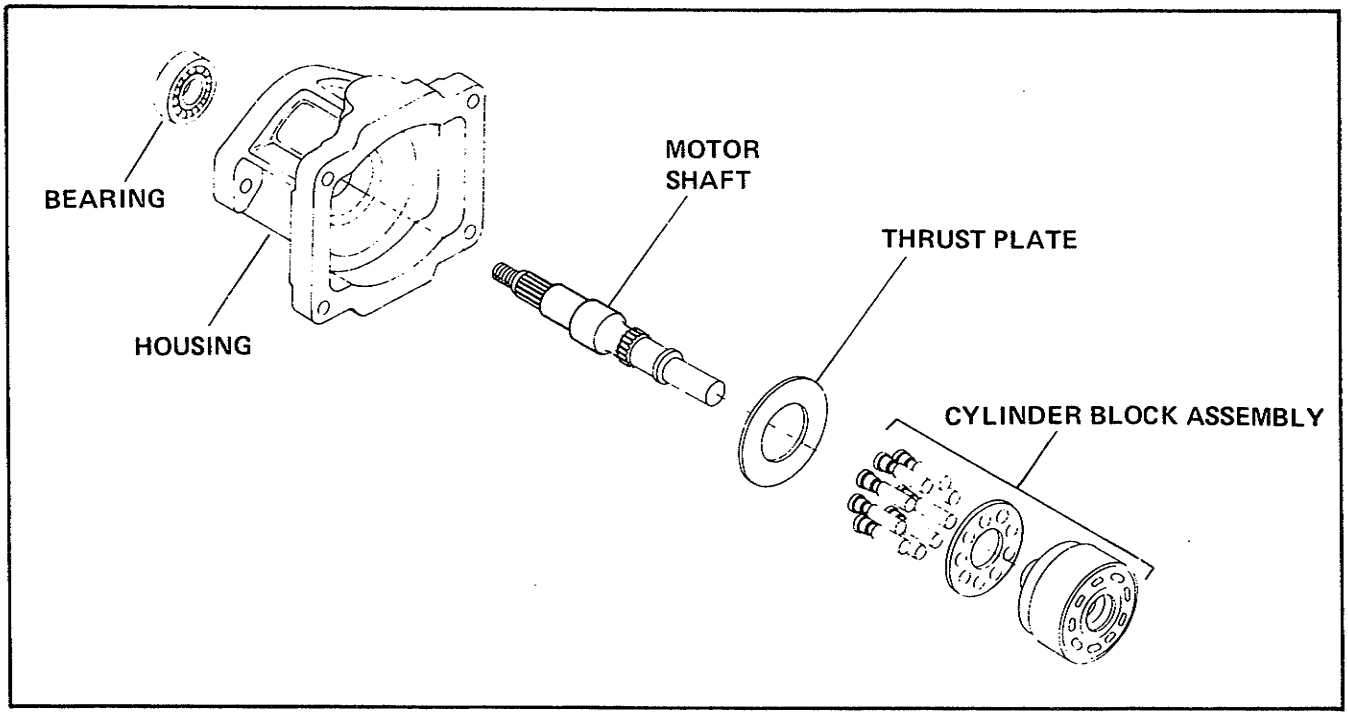


Figure 120. Disassembly Motor Section

Visually inspect wear surfaces of valve plate, cylinder block and slippers for damage. Check to be sure pistons are free in bores.

Remove thrust plate from counterbore in motor housing. Visually inspect both sides for damage and flatness.

The motor shaft can be pressed into the housing and the bearing must be pressed out of the housing.

Pump Section

Pull Pump section (keyed shaft end) away from center section (see Figure 122). Valve plate usually stays on center section. Remove the valve plate but do not allow it to fall when separating this section. Keep the pump valve plate separate from the motor valve plate as they are not interchangeable. Remove gasket.

Lift out the cylinder block assembly. See Figure 121. This is the same for pump and motor sections. The pistons may come out of the cylinder block. There is no special orientation of piston to bore that need to be maintained. Do not attempt to disassemble the spring and other parts from the center

Place the pump housing with the large cavity up. Use care not to mar the port face surface.

Using a 3/16 diameter drift punch, drive spring pin out of trunnion and control shafts. The pump housing is provided with a cast recess so that the pins can be driven free of trunnion and control shafts

Drive control shaft out of swashplate bore toward outside of housing. Once clear of swashplate bore, the shaft can be removed easily. Repeat to remove trunnion shaft. The swashplate is then removed from the pump housing.

bore of the cylinder block. The entire cylinder block assembly should be replaced if any of its components are damaged.

Visually inspect wear surfaces of valve plate, cylinder block and slippers for damage. Check to be sure pistons are free in bores.

Remove thrust plate from counterbore in face of swashplate. Visually inspect both sides for damage and flatness.

Press out shaft towards the large opening. See Figure 122.

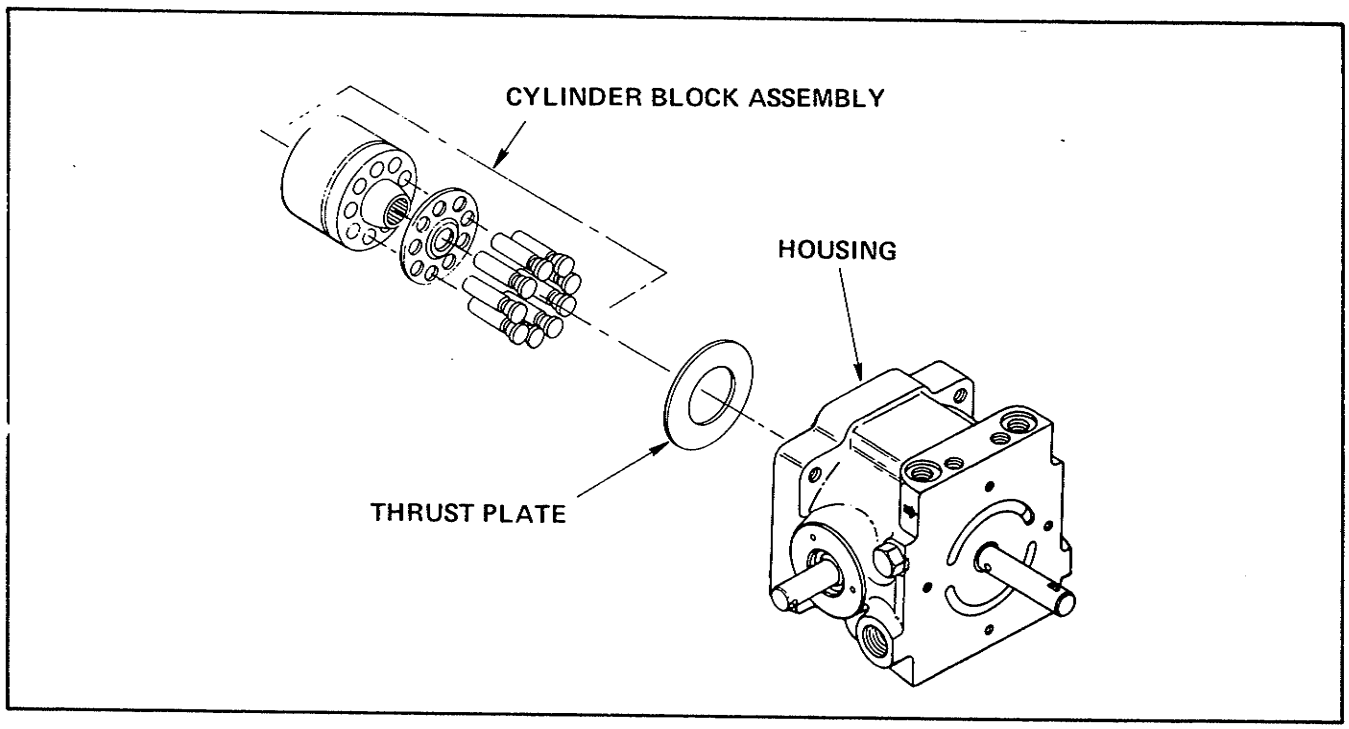


Figure 121. Disassembling Pump Section

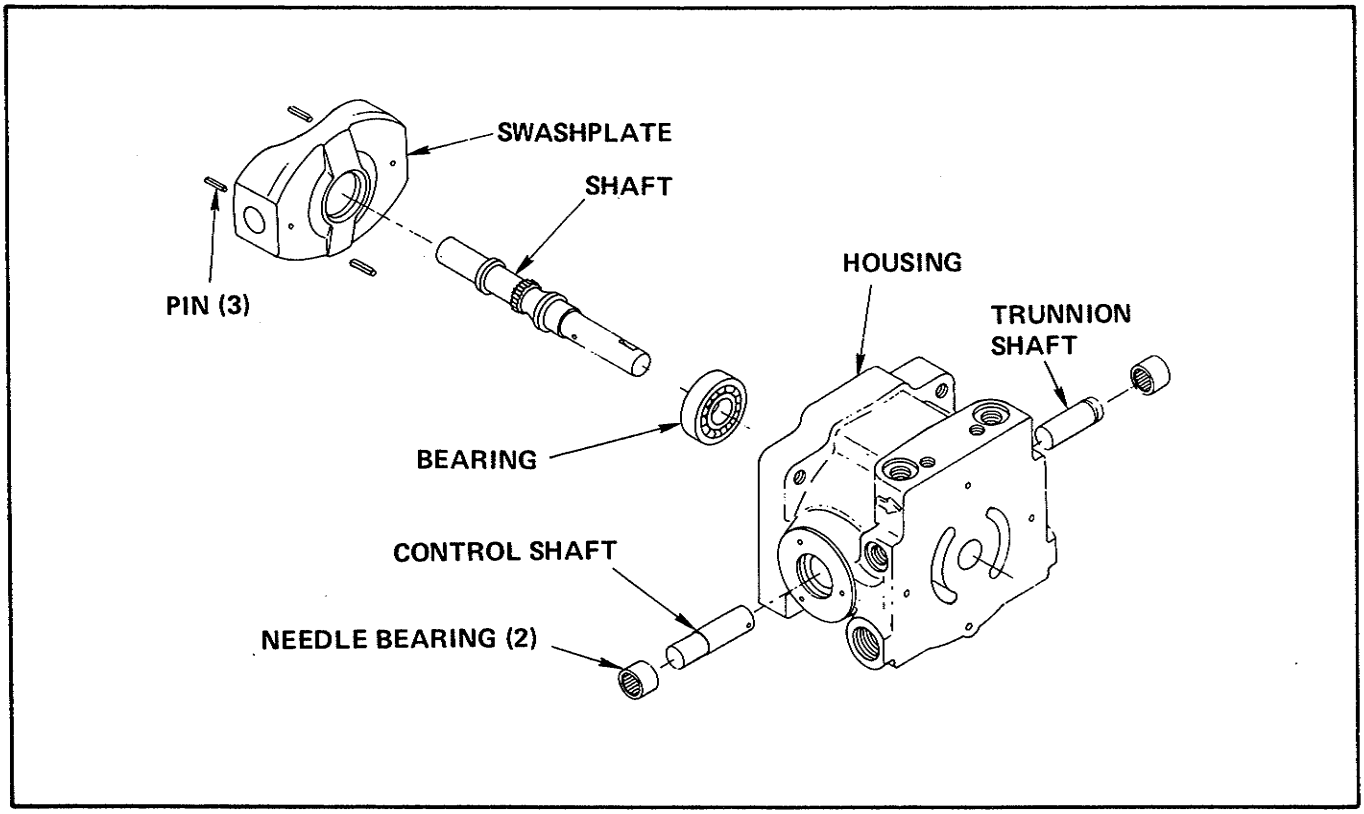


Figure 122. Disassembling Pump Section Continued

The bearing can be removed from the housing, pressing towards the large opening.

Inspect the needle bearings. If replacement is required press out the old bearings.

Center Section

Remove slotted plugs located on the motor side of the center section. See Figure 123. You will need a drag link socket to break the 50 (ft. lbs.) torque installation values. Remove springs and balls from bores in center section. The parts from these two check valves are interchangeable. Replace parts as required and reinstall into center section.

Visually inspect needle bearings and replace if necessary by pressing out of center section. When replacing needle bearings, press into center section leaving 1/16 to 1/8 inch of bearing protruding beyond face. The valve plates pilot on these bearings. See Figure 124.

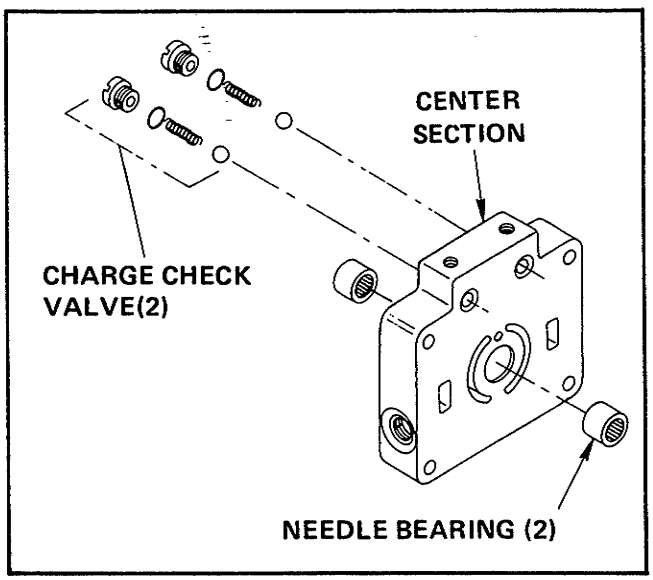


Figure 123. Disassembling Center Section

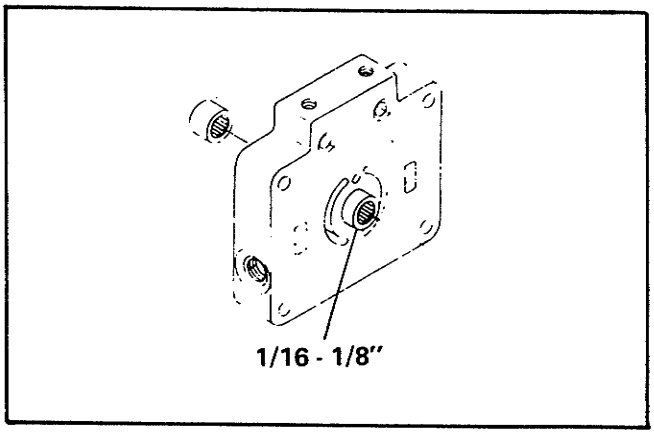


Figure 124. Installing Bearings into Center Section

REASSEMBLY

Motor Section (Refer to Figure 120)

Press bearing into housing. Press shaft into bearing mounted in housing.

Assemble cylinder block parts if necessary and lubricate with clean hydraulic oil. There is no special orientation of piston to bore that needs to be maintained, however, parts are not interchangeable between cylinder block assemblies.

Hold the cylinder block in the palm of your hand with pistons up. Lubricate thrust plate and lay it on top of pistons and block. Lower housing assembly over cylinder block until shaft spline engates cylinder block assembly. Be certain that pistons and thrust plate remain in place. When properly installed a slight spring tension can be felt when pushing on cylinder block. Lubricate exposed surface of cylinder block with clean hydraulic oil.

Pump Section (Refer to Figures 118, 121 and 122)

Press shaft bearing into housing. Place housing with large cavity up. Use care not to mar the port surface. Press needle bearings into each side of housing until flush to 1/64 inch below counterbore for lip seals.

Place swashplate into housing with counterbore for thrust plate up. Install control and trunnion shafts (54 and 58) being certain control shaft is on proper side. Align holes in swashplate and shaft.

Install new pins through swashplate and shafts. Use two (2) pins on control shaft, installing first pin until second pin can be started, then driving in both pins together until the last pin is 1/4 inch below swashplate. See Figure 125.

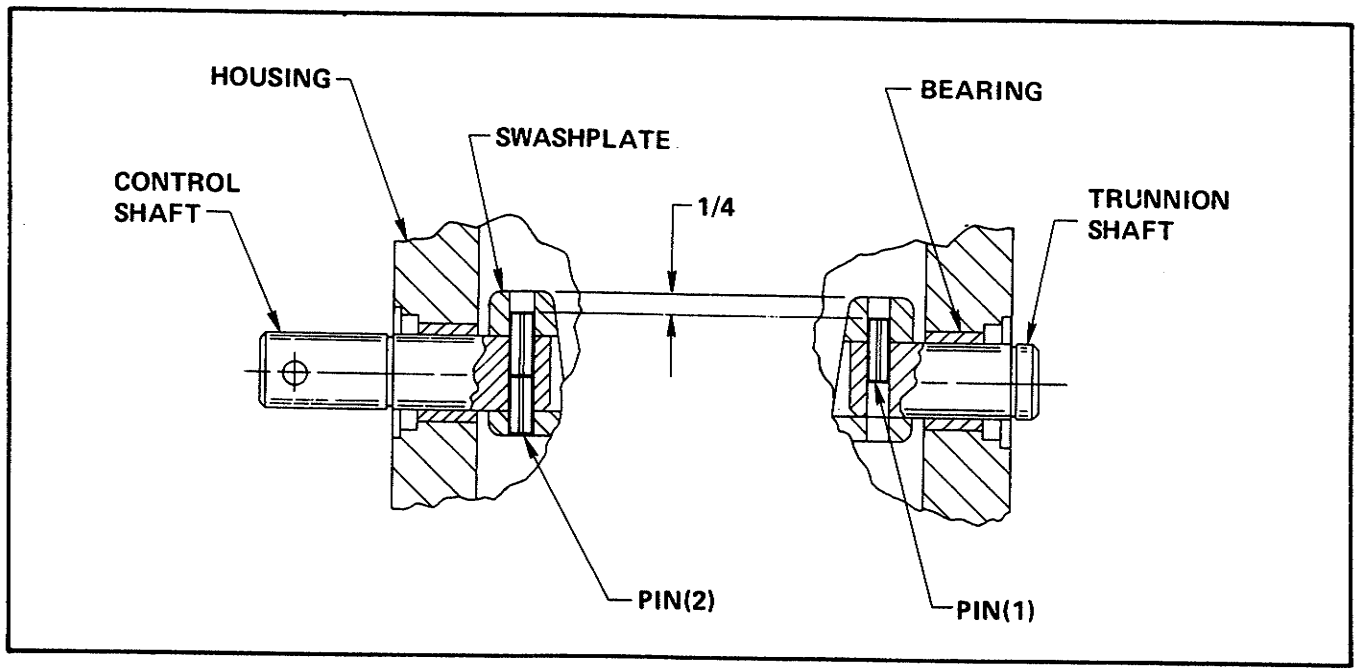


Figure 125. Attaching Swashplate to Trunnion Shaft

The swashplate should swing freely in the pump housing to 15 degrees each side of center.

Press shaft into bearing through center hole in swashplate.

Assemble cylinder block parts if necessary and lubricate with clean hydraulic oil. There is no special orientation of piston to bore that needs to be maintained, however, parts are not interchangeable between cylinder block assemblies.

Hold the cylinder block in the palm of your hand with pistons up. Lubricate thrust plate and lay it on top of pistons and block. Lower housing assembly over cylinder block until shaft spline engages cylinder block assembly. Be certain that pistons and thrust plate remain in place. When properly installed a slight spring tension can be felt when pushing on cylinder block.

Lubricate exposed face of cylinder block with clean hydraulic oil.

Center Section

Properly orient the center section to the pump section. The side with the two O-rings goes toward the pump section. Align with the mating holes in the pump housing. See Figure 126.

Insert locating pin into pump side of center section. Lubricate the slotted side of the pump valve plate and slip it over locating pin and protruding needle bearing.

The pump valve plate has two vee notches (the motor valve plate has four vee notches). See Figure 127.

NOTE

Insert locating pin into the motor side of center section. Lubricate the slotted side of the motor valve plate and slip it over locating pin and protruding needle bearing.

Insert O-rings and place gasket on each side of center section. A small amount of oil will hold these parts in place.

Reassembling Three Main Sections (Refer to Figure 119 above)

Place center section onto pump section being careful that valve plate and cylinder block assembly remain in place.

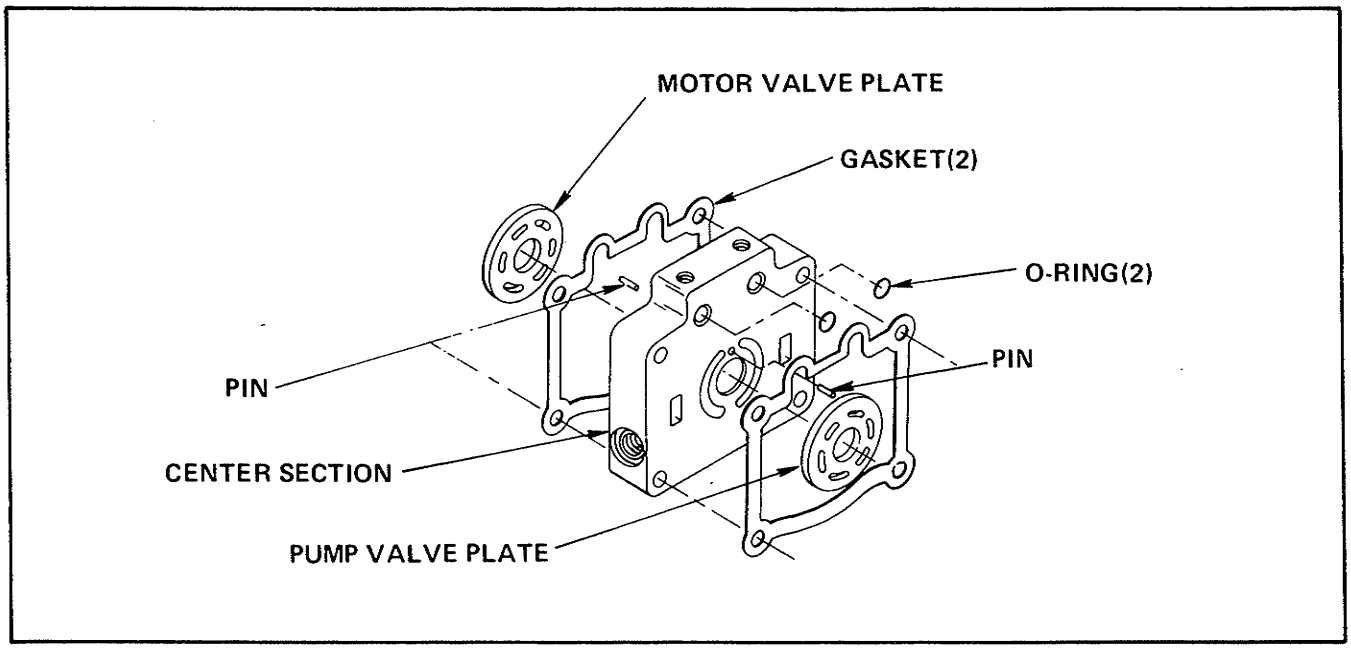


Figure 126. Reassembling Center Section

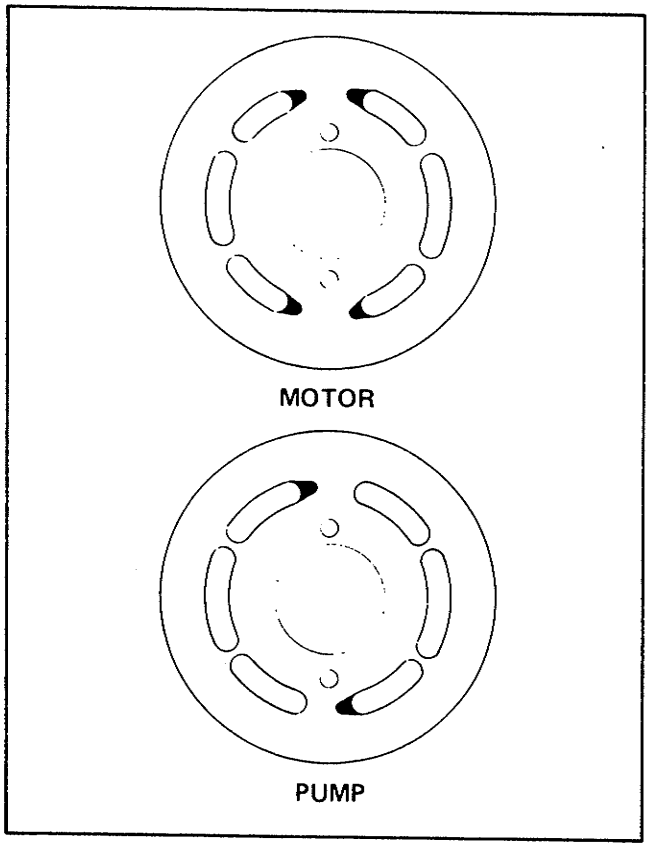


Figure 127. Valve Plates

Properly orient the motor housing to the center section. The high point of the cam angle machined in housing must be on the same side as the charge check valves. See Figure 128.

Place the pump section onto the center section being careful that the valve plate and cylinder block assembly remain in place.

Insert four hex, head screws with nameplate under one screw. Tighten these screws equally and pull the three sections together completely. Torque screws to 33-35 ft-lbs.

Install new lip seals (Figure 118). Install remaining components, charge pump and valves as described at the beginning of the manual.

PRIMING PROCEDURE See page 1-43.

Remove both spark plug wires and disconnect B+ wire at the coil. Remove charge relief valve pipe plug on top of pump housing (Figure 107). Add hydrostatic fluid through port until it flows from port.

Turn engine over with battery until fluid flows from port with no air bubbles. Cranking may have to be stopped and fluid added several times until fluid flows again from port.

Check Charge Relief pressure and Implement Relief pressure as given in the TEST section of this manual.

TESTING AFTER REPAIR

After repairing and reinstalling the hydrostatic unit, test for proper operation. Check for leaks, especially at lip seals and where sections join together. If necessary, refer to troubleshooting section of this manual and correct malfunction.

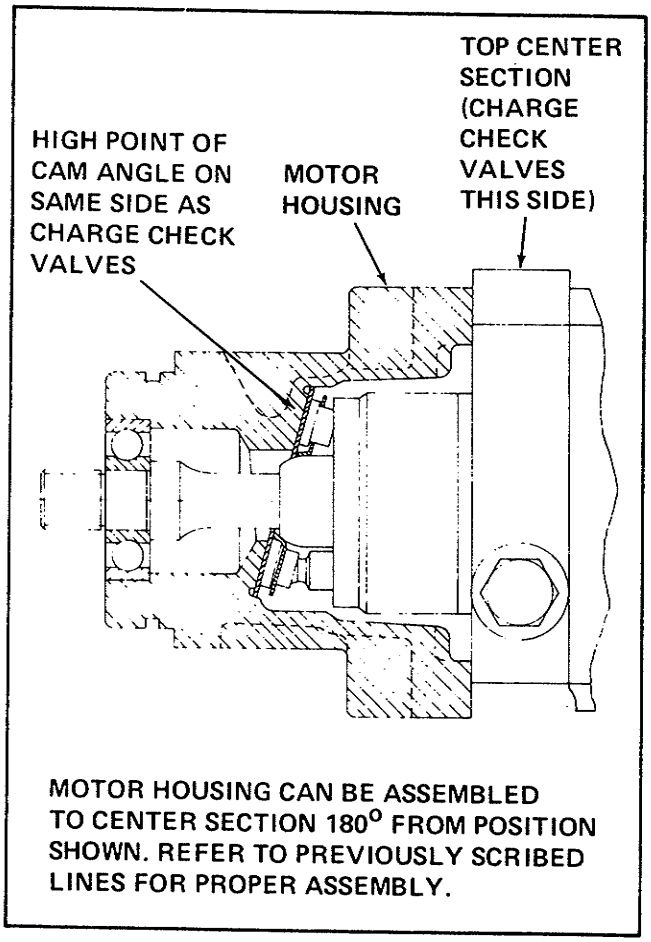
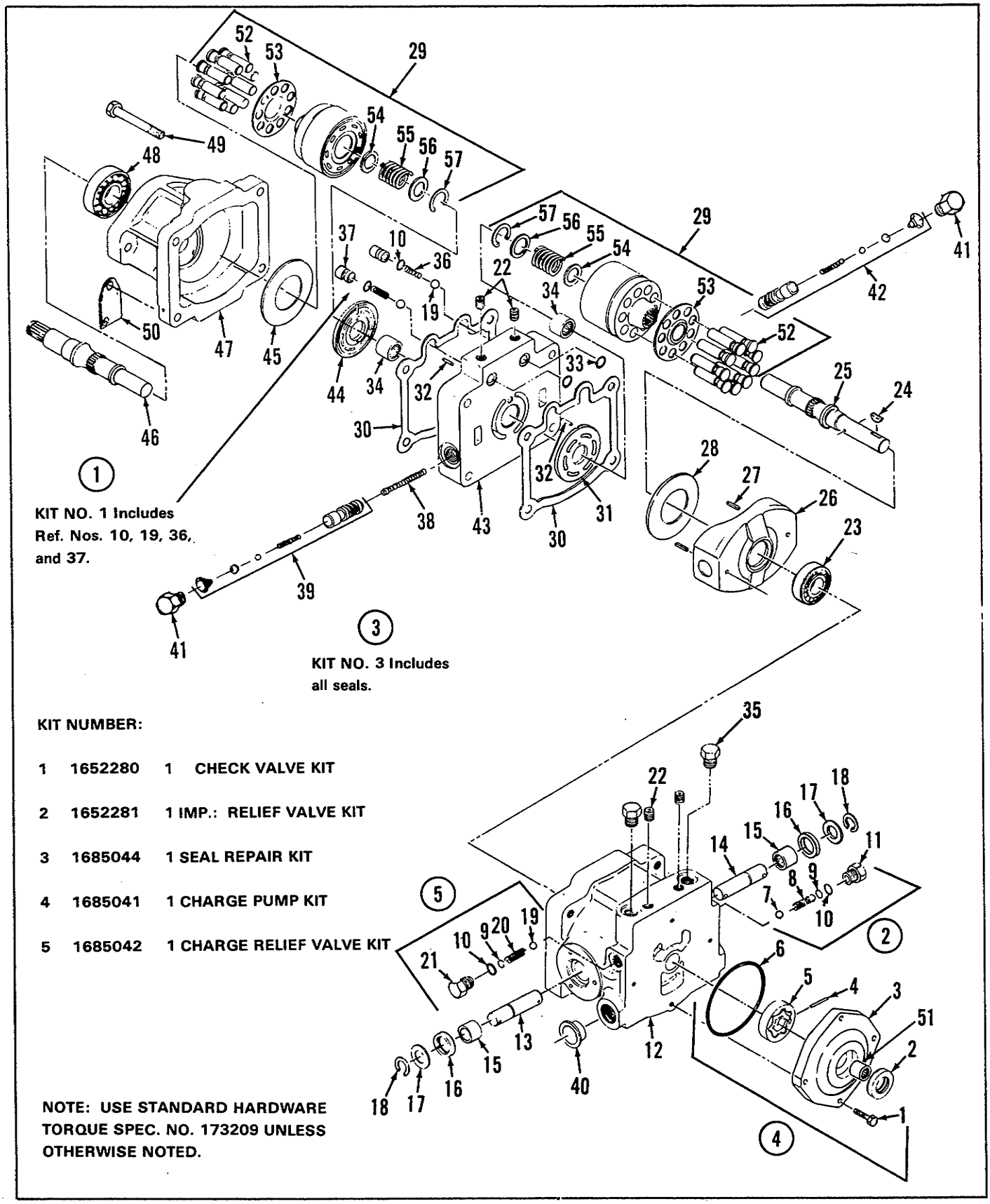


Figure 128. Connecting Motor Housing to Center Section



KIT NUMBER:

1	1652280	1	CHECK VALVE KIT
2	1652281	1	IMP.: RELIEF VALVE KIT
3	1685044	1	SEAL REPAIR KIT
4	1685041	1	CHARGE PUMP KIT
5	1685042	1	CHARGE RELIEF VALVE KIT

NOTE: USE STANDARD HARDWARE TORQUE SPEC. NO. 173209 UNLESS OTHERWISE NOTED.

Ref. No.	Part No.	Qty.	Description	Kit
1	921977	4	CAPSCREW, Hex Hd.	4
2	1652232	1	SEAL, Lip	3,4
3	1652241	1	HOUSING, Charge Pump	4
4	1652242	1	PIN, Headless, Str.	3,4
5	1652243	1	GEROTOR ASSY.	4
6	1652244	1	"O" RING	3,4
7	1652245	1	VALVE, Impeller Relief	2
8	1652246	1	SPRING, Impeller Relief Valve	2
9	1652216	A/R	SHIM PACK	2,5
10	1652191	4	"O" RING	1,2,3,5
11	1652247	1	PLUG, Hex Hd.	
12	1652248	1	HOUSING, Pump	
13	1652249	1	SHAFT, Trunnion	
14	1652250	1	SHAFT, Trunnion	
15	1652251	2	BEARING, Needle	
16	1652234	2	SEAL, Lip	3
17	1652235	2	WASHER	3
18	1652192	2	RING, Retaining	3
19	1652252	2	BALL	1,5
20	1652253	1	SPRING, Charge Relief Valve	5
21	1652255	1	PLUG, Hex Hd.	5
22	1652213	6	PLUG, Pipe	
23	1652231	1	BEARING, Ball	
24	1652256	1	KEY, Woodruff	
25	1652257	1	SHAFT, Pump	
26	1652258	1	PLATE, Swash	
27	1652226	3	PIN, Coiled Spring	3
28	1652259	1	PLATE, Thrust	

Ref. No.	Part No.	Qty.	Description	Kit
29	1652188	2	CYLINDER BLOCK KIT	
30	1652260	2	GASKET	3
31	1652261	1	PLATE, Valve	
32	1652224	2	PIN, Headless Str.	
33	1652262	2	"O" RING	3
34	1652263	2	BEARING, Needle	
35	1652264	2	PLUG, Plastic	
36	1652265	2	SPRING, Check Valve	1
37	1652266	2	SPRING, Check Valve	1
38	1652267	1	SPRING, Acceleration	
39	1652268	1	VALVE, Acceleration	
40	1652269	1	PLUG, Plastic	
41	1652270	2	PLUG, Hex Hd.	
42	1652271	1	VALVE, Acceleration	
43	1652272	1	SECTION, Center	
44	1652273	1	PLATE, Valve	
45	1652274	1	PLATE, Thrust	
46	1652275	1	SHAFT, Motor	
47	1652276	1	HOUSING, Motor	
48	1652181	1	BEARING, Ball	
49	1652277	4	CAPSCREW, Hex Hd.	
50	1652278	1	NAMEPLATE	
51	1652279	1	BEARING, Needle	4
52	1656008	18	PISTON, (Comes in Qty. of 9)	
53	1656009	2	RETAINER	
54	1656007	2	WASHER	
55	1656006	2	SPRING	
56	1656005	2	WASHER	
57	1656004	2	RING, Retaining	

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