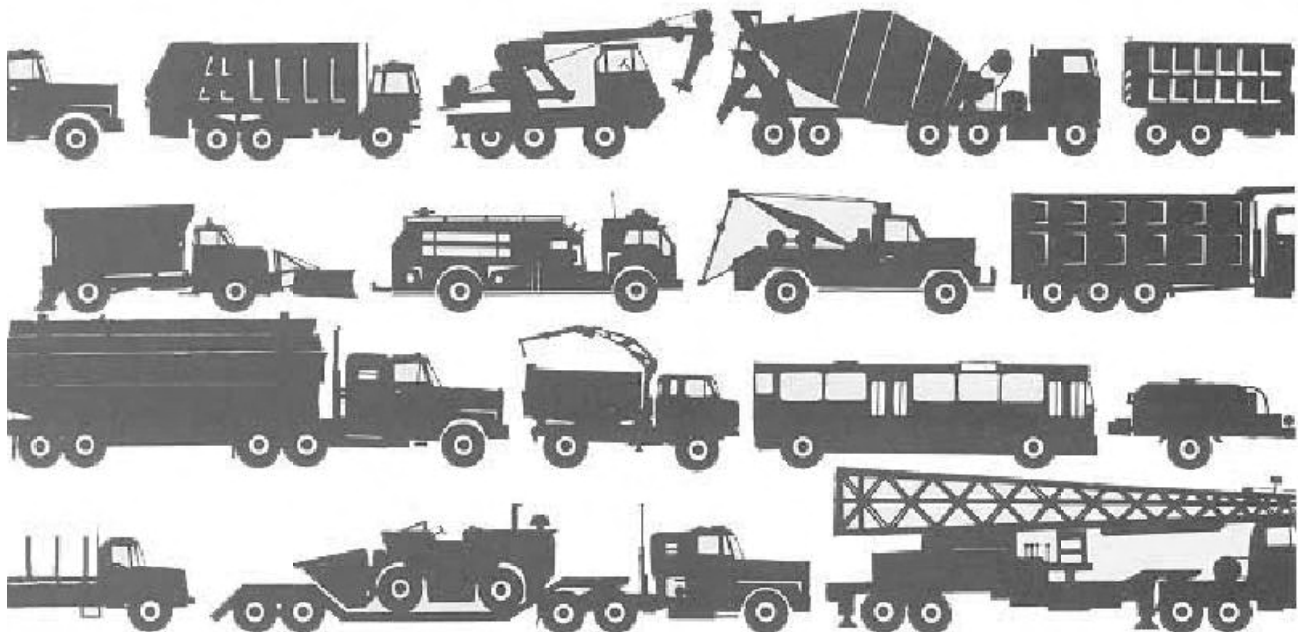


TC-160 TRANSFER CASE AND PTO-160 SPLIT-SHAFT PTO SERVICE MANUAL



A business unit of **tti**

Fabco Automotive Corporation
Service and Parts Manual
Models TC-160 and PTO-160

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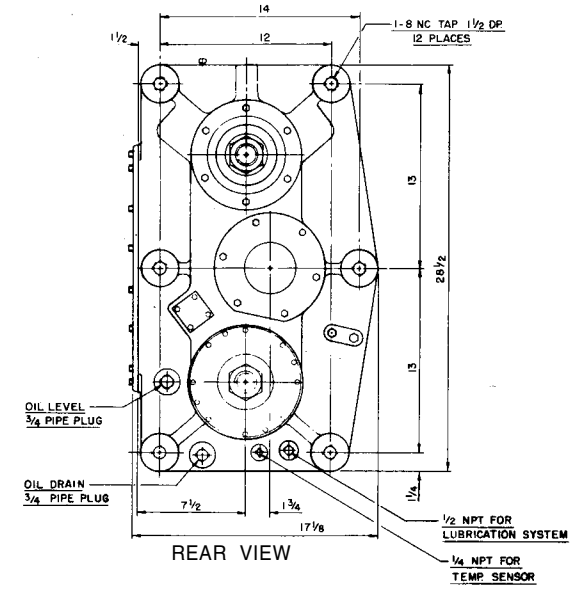
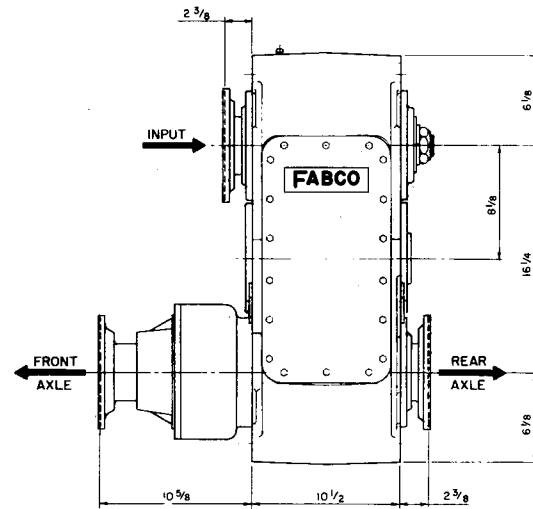
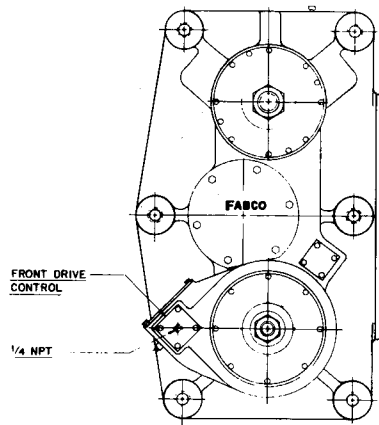
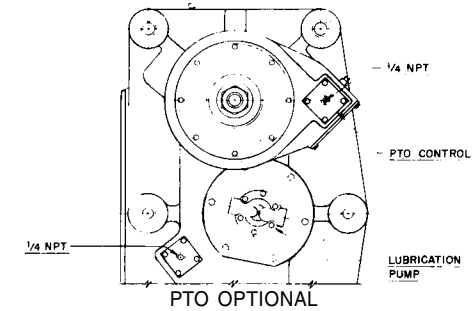
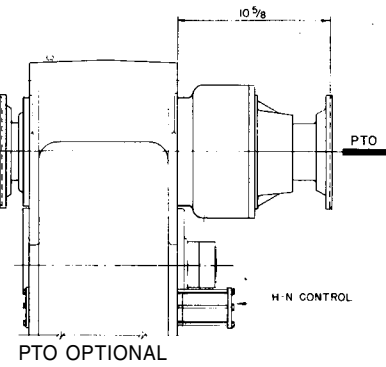
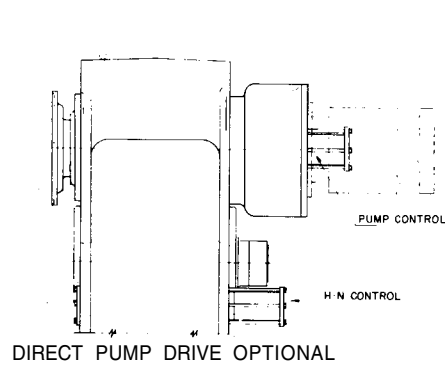
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PARTS MANUAL

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OPTIONS:

FLANGES 1710 OR 1810 SERIES.

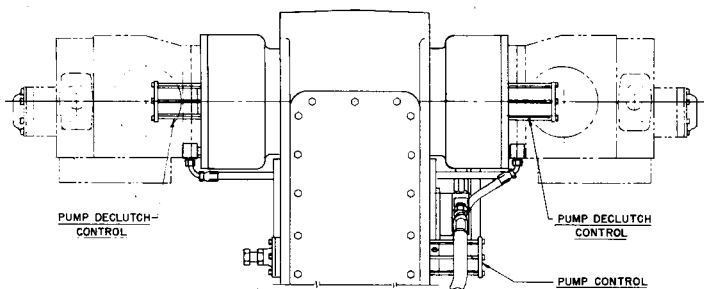
NEUTRAL CAPABILITY

LUBRICATION SYSTEM (PRESSURE)

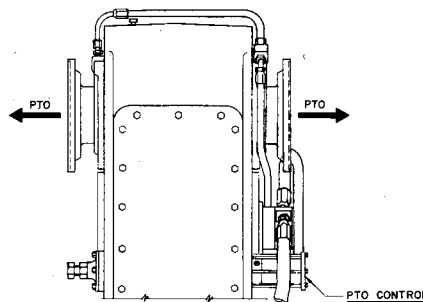
POWER TAKE-OFF

DIRECT DRIVE PUMP

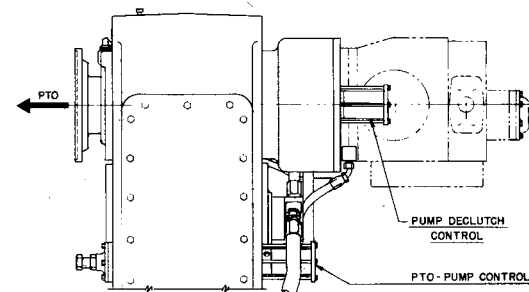
Kelsey-Hayes A DIVISION OF FAYAT INDUSTRIES, INC.		Fabco Division BALTIMORE, CALIFORNIA	TRANSFER CASE SINGLE SPEED MODEL TC-160	
DRAWN BY R.F. PERRY	DATE 9-20-82	SCALE 1/4"	CHECKED BY PART NUMBER 555 106	
DO NOT SCALE DRAWINGS			REV. 8	QUANTITY 1



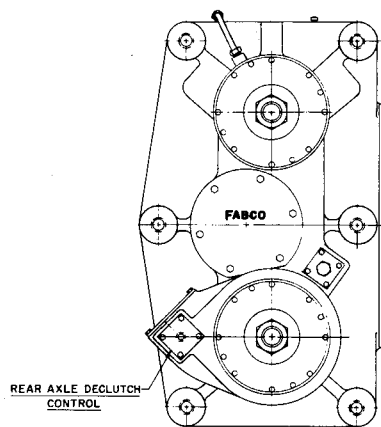
DUAL-DIRECT PUMP DRIVE OPTIONAL



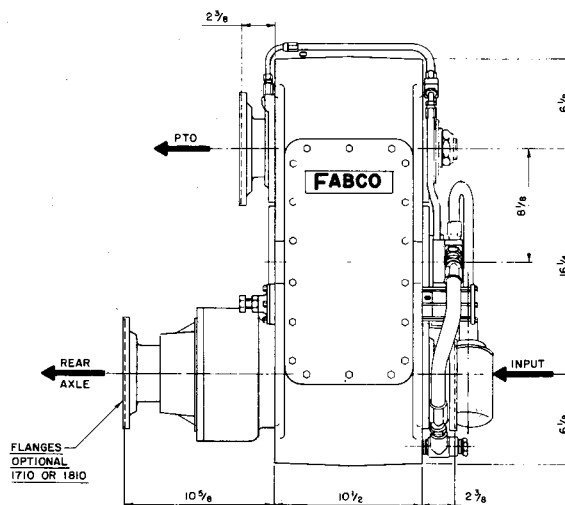
DUAL PTO OPTIONAL



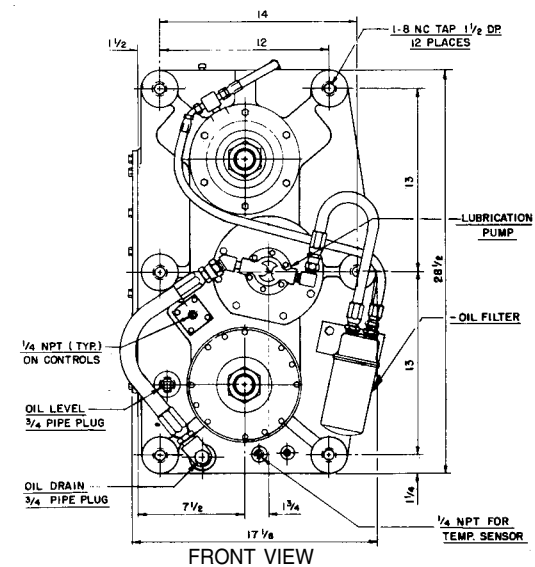
PTO WITH DIRECT DRIVE PUMP OPTIONAL



REAR VIEW

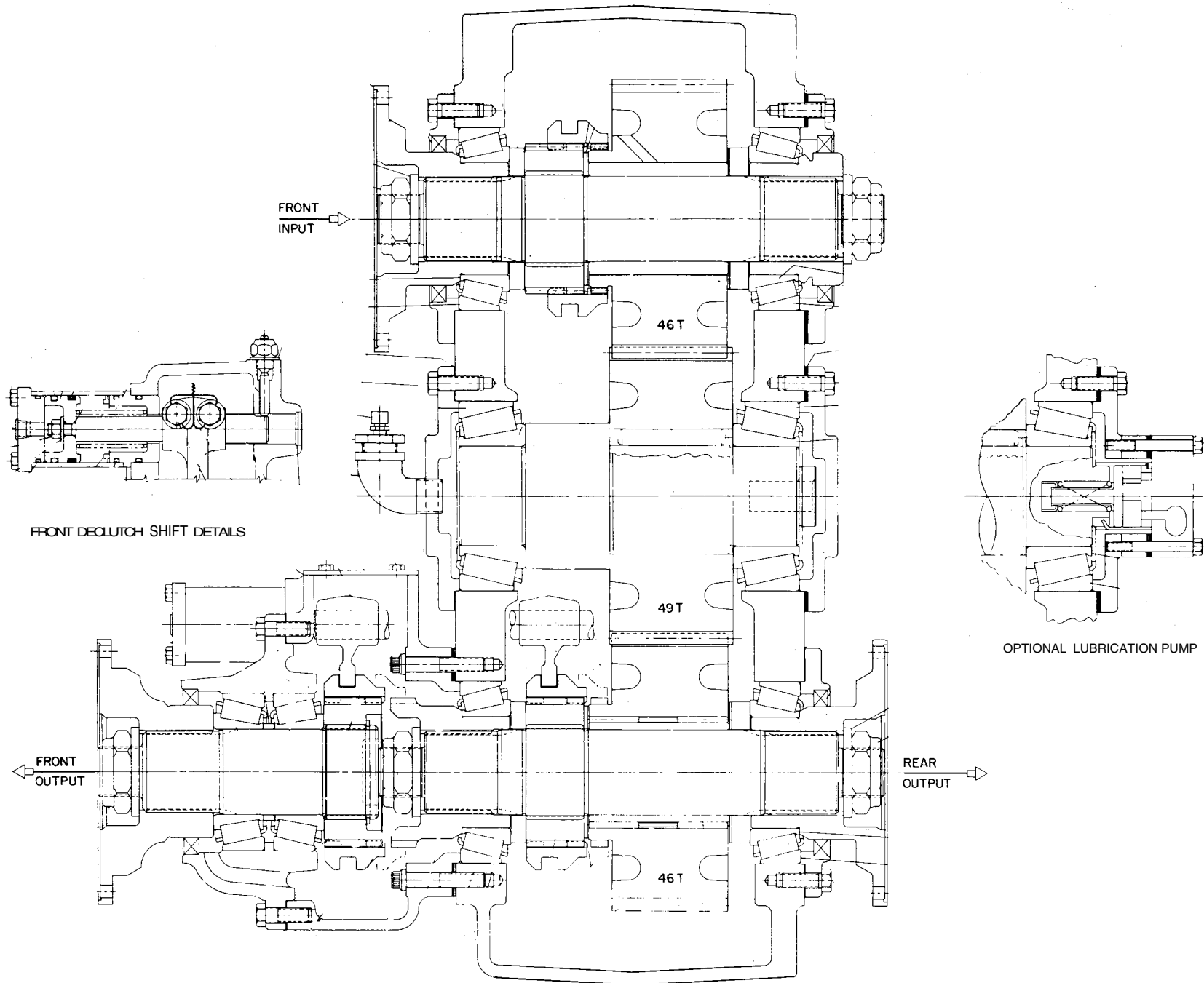


SIDE VIEW (RH)



FRONT VIEW

Kellogg-Hayes		Fabco Motion		POWER TAKE OFF CASE	
A DIVISION OF KELSEY-HAYES CORPORATION		MILWAUKEE, WISCONSIN		SPLIT SHAFT	
DESIGNER: R. F. PERRY		DATE: 11-1-82		MODEL PTO-160	
DRAWN: [blank]		SCALE: 1/4"		DRAWING OR PART NUMBER	
CHECKED: [blank]		DO NOT SCALE		555 107	
APPROVED: [blank]		DRAWINGS		LATEST REV. 1 OF 1	



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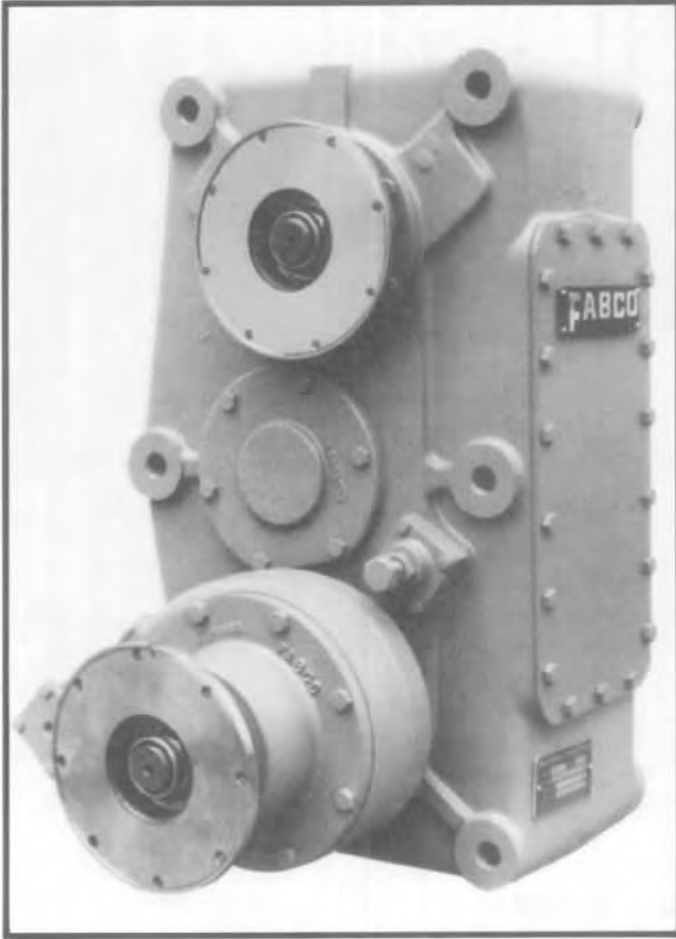
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**906 W. Gore St.
Orlando, FL 32805**



I. OPERATING INSTRUCTIONS



A. Front Drive

When traveling through sand, loose dirt, mud, snow or ice, or when ascending grades where the rear wheels might spin, shift to front wheel drive for better traction. Shift before the truck is in trouble. Engagement and disengagement of the front axle can best be made while the engine is pulling lightly. It can be shifted at any speed provided the rear wheels are not spinning. An indicator switch is actuated when the shifter shaft is in the engaged position.

B. Transfer Case PTO

If the transfer case has a PTO or Direct Pump Drive, the PTO may be operated with the vehicle stationary or moving, depending on how the air shift controls are arranged. If there is only one valve lever labeled PTO/NEUTRAL, the PTO and Neutral actuating cylinders are operated together by one valve; PTO operation is only possible when the transfer case is in Neutral. If two valves are present, labeled PTO and NEUTRAL separately then the operator has a choice of PTO while moving or in stationary operation. Moving PTO operation is limited by the fact that engine speed for ground movement may not be the best speed for the PTO operation.

To engage the PTO (single valve operation) stop the vehicle, set the brakes, shift to PTO/NEUTRAL and shift the transmission to the desired gear. If the vehicle has an automatic transmission, it may be necessary to shift the gear selector to Neutral momentarily to allow the PTO and Neutral to shift. An indicator switch is actuated when the PTO shift shaft is in the engaged position.

To disengage the PTO (one valve), stop the drive train by shifting the transmission to Neutral. Allow the shafts to come to rest, and shift the PTO/NEUTRAL valve to disengage. This automatically re-engages the rear axle.

If separate PTO and Neutral valves are used, operation is the same as with one valve, except the Neutral valve can be selected independently of the PTO.

C. PTO-160 Split-Shaft PTO

The PTO-160 is equipped with double-acting cylinders requiring four-way valves for control. Operation of the PTO-160 is the same as the operation of the transfer case PTO or Direct Pump Drive. The rear axle disconnect is in the declutch housing on the rear of the PTO-160.

If separate PTO outputs require separate operation, there will be a control for each. Operation is still the same.

II. LUBRICATION

On Highway Vehicles

Type	Grade	Temperature
MIL-L-2104	SAE 50	Above + 10°F.
Heavy-Duty Engine Oil	SAE 30	Below + 10°F.
Mineral	SAE 90	Above + 10°F.
Gear Oil	SAE 80	Below + 10°F.
MIL-L-2105 E.P.	SAE 90	Above + 10°F.
Oil, except Sulfur-chlorine-lead type.	SAE 80	Below + 20°F.

Heavy-duty engine oil. Make sure to specify heavy-duty type meeting MIL-L-2104 specifications.

Mineral gear oil inhibited against corrosion, oxidation and foam.

Off Highway & Mining Equipment

Type	Grade	Temperature
MIL-L-2104	SAE 50	Above + 10°F.
Heavy-Duty Engine Oil	SAE 30	Below + 10°F.
Special Recommendation--For extreme cold weather where temperature is consistently below 0°F.		
MIL-L-2104	SAE 20W	Below 0°F.
Heavy-Duty Engine Oil		
MIL-L-2105 C	SAE 75W-90	Below 0°F.

II. LUBRICATION

NOTE: Oil Change and Inspection Recommendations:

The oil change and inspection periods described below are based on the average use and operating conditions the transfer case may encounter. It is recommended that the individual owner make a periodic lab analysis of the lubricant to determine contamination based on the individual's own operating conditions. With this data the individual owner can better determine their own oil change and inspection periods.

B. Transfer Case Oil Change

Transfer case lubricant should be changed on all new transfer cases after the first 3,000 to 5,000 miles (on-highway), or first 40 hours (off-highway); thereafter, oil changes should be done at the following intervals:

On-Off Highway Service 10,000 - 15,000 miles

Off-Highway Service
(Logging, dirt moving, mining
and associated operations) 500-750 hours,
as indicated by operation and contamination of
lubricant.

C. Draining Oil

Draining is best accomplished after the vehicle has been operated briefly, allowing the oil to become warm and flow freely. Remove both drain and fill plugs and allow housing to empty completely. After transfer case has been drained and before it is refilled, the case should be thoroughly flushed with clean flushing oil or kerosene.

If case is equipped with an oil pump, the lube oil filter should be replaced whenever the oil is changed. The filter element is a spin-on type. A film of clean oil should be applied to the rubber gasket seat of the new element before installing.

D. Refilling Oil

If the transfer case has been removed from the vehicle for service, it is best to refill the oil after the transfer case has been reinstalled into the vehicle.

Clean and replace drain plug and fill the transfer case with appropriate gear oil with the vehicle on level ground (see recommended lubricant chart). Fill transfer case to the level of the fill plug, metering approximately 10 quarts of gear oil into the transfer case. The exact amount may differ depending upon the inclination of the transfer case. Always fill to the level of the fill plug. Replace fill plug and examine transfer case for leaks around plugs and gasket sealed areas.

Do not overfill the transfer case.

E. Inspection

Gear oil level is to be maintained at the level of the fill plug at all times. Check at the following intervals:

Highway Service	1,000 miles
Off-Highway Service	40 hours

F. Operating Temperature

The operating temperature of the transfer case (or PTO) should never exceed 250°F (120°C). Operation at temperatures exceeding 250°F will result in rapid breakdown of the oil and shorten the transfer case life. If the case is equipped with a lubricating pump, an oil cooler may be plumbed into the circuit, on the output side of the pump. The PTO-160 is standard with a lube pump, and should always have an oil cooler, if operating temperature runs over 250°F.

G. Shift Cylinder Inspection

With every oil change the air shift cylinder lines and valves should be inspected for leaks and possible malfunctioning. Low pressure conditions can cause partial clutch tooth engagement which may result in "gear jumping" and premature wear.

III. TRANSFER CASE REMOVAL AND INSTALLATION

A. Removal from Vehicle

1. Remove fill and drain plugs and drain lubricant.
2. Disconnect indicator light wires.
3. Disconnect the air shift lines. Be sure to tag the lines for future identification. Disconnect oil cooler lines if present.
4. Disconnect drivelines at flanges.
5. If the transfer case is equipped with a PTO mounted hydraulic pump, remove the mounting bolts, slide the pump out of the transfer case and secure pump to the frame and out of the way.

NOTE: If it is desired, the hydraulic lines can be disconnected and the pump can be detached after the transfer case has been removed from the vehicle,

6. Position a transmission jack of suitable capacity beneath the transfer case (800 lb. transfer case). Be sure that the transfer case is seated safely on the jack.
7. Disconnect transfer case mountings at rubber insulators. Since mountings vary, consult the vehicle service manual.
8. Check to ensure that all mountings and connections to the transfer case have been disconnected. Lower the transfer case to the floor and remove from under the vehicle. It may be necessary to jack the vehicle up to allow room to remove the transfer case.

B. Installation into Vehicle

1. Place transfer case on transmission jack and position jack and transfer case under the vehicle.
2. Raise transmission jack and position transfer case.
3. Connect transfer case mountings. Since mountings vary, consult the vehicle service manual.
4. Connect drivelines.
5. Connect shift cylinder air lines to air cylinders.
6. Install hydraulic pump to transfer case if it is not already.
7. Connect indicator light lead wires to terminals.
8. Fill transfer case housing with appropriate lubricant to the correct level and install fill plug. (Refer to lubrication, Section II.)
9. Road test the vehicle by driving slowly with no load for the first few moments, then test at a higher speed listening for any problems.
10. Check transfer case for leaks around gaskets and seals.

IV. TRANSFER CASE DISASSEMBLY

A. General Precautions for Disassembly

IMPORTANT: Read this section before starting the disassembly procedures.

It is assumed in the disassembly instructions that the lubricant has been drained from the transfer case and the transfer case has been removed from the chassis.

Follow each procedure closely in each section, making use of both text and pictures. Refer to the views located in the Parts Manual as an aid in disassembly.

1. The outside of the unit should be cleaned before starting the disassembly. If steam cleaning, ensure that breather and air fittings are covered to prevent water from entering assembly.
2. Cleanliness—Provide a clean place to work. It is important that no dirt or foreign material enters the unit during repairs.
3. Position the transfer case in a stand suitable to support the transfer case.
4. Assemblies—When disassembling the various assemblies, lay all parts on a clean bench in the same sequence as removed. This procedure will simplify reassembly and reduce the possibility of lost parts.
5. Bearings—Carefully wash and relubricate all bearings as removed and protectively wrap until ready for use. Remove bearings with pullers designed for this purpose, or in a manner which will not damage those bearings that will be reused.

CAUTION: SOME BEARINGS CANNOT BE REMOVED WITHOUT BEING DAMAGED, AS NOTED IN THE TEXT. IF THE BEARING OR MATING PART IS NOT WORN, OR BROKEN, LEAVE THEM ASSEMBLED AND REUSE THEM. IF THE BEARING IS WORN OR DAMAGED, REMOVE AND REPLACE. IF THE SLEEVE ON WHICH THE BEARING IS MOUNTED IS DAMAGED OR WORN, DISCARD BOTH PARTS AND REPLACE BOTH SLEEVE AND BEARING.

6. Snap Rings—Remove snap rings with pliers or special tools designed for this purpose. Rings removed in this manner can be reused.
7. When necessary to apply a force to remove a part, use of a puller or press would be preferred. However, sometimes it may be necessary to use a soft hammer or mallet.
8. The PTO-160, the Split-Shaft Power Take-Off version of the TC-160, is different only in use of double-acting cylinders instead of single-acting, a larger capacity lubrication pump (otherwise identical to that of the TC-160), and that it is installed in reversed position from the transfer case. Disassembly and assembly procedures are identical, except that all references to front or back of the transfer case will be reversed when working on a PTO-160. Especially, the front axle declutch on the transfer case is the rear axle declutch on the SSPTO.

B. Preliminary Disassembly

1. Remove any mounting brackets.
2. Remove lubrication hoses and filter bracket from case.

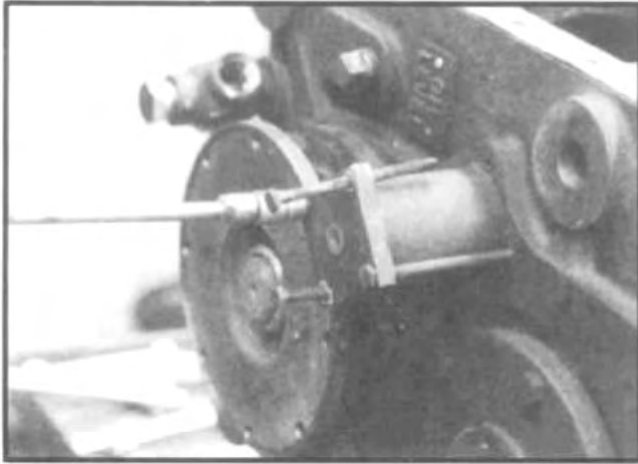


3. Remove lube pump housing and rotor assembly. Pull spring from hole in shaft.
4. Remove axle declutch carrier assembly and PTO declutch carrier assembly (if present). (SEE SECTION D.) Leave the empty housings bolted on until the input and output flanges are removed.

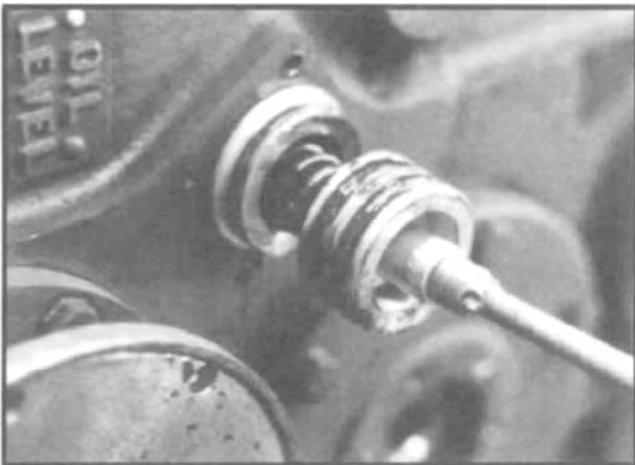
IV. TRANSFER CASE DISASSEMBLY

C. Shift Cylinder Disassembly

If the case is not equipped with neutral, shift shaft bores will be capped off. PTO-160 will always have a shift shaft in the main case, but its function is to engage and disengage the PTO output(s).



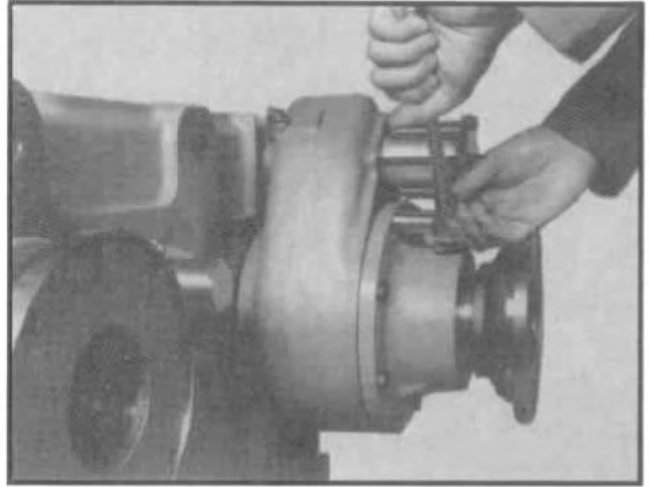
1. Remove four bolts from the shift cylinder cap and remove cap from shift cylinder. Discard O-ring from cylinder cap, if replacement is necessary.
2. Remove shift cylinder tube from the shift cylinder adapter tube located in the housing, exposing piston.



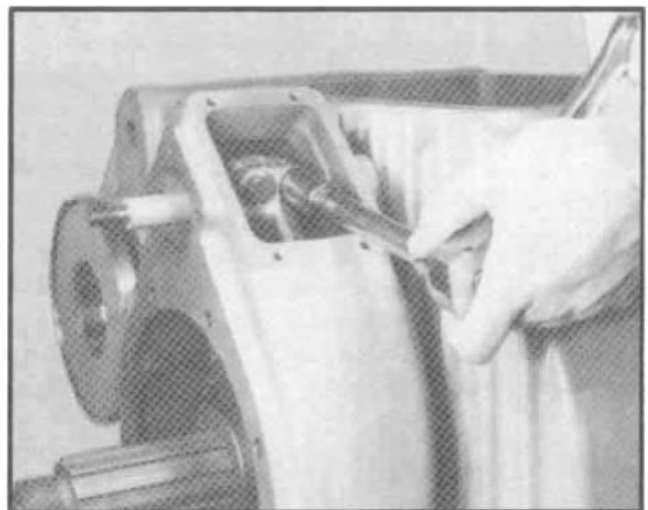
3. Disassemble shift piston from the shift shaft and discard O-ring and felt wiper, if replacement is necessary.
4. Remove shift shaft spring and plastic stop ring from the shift shaft or from the shift cylinder adapter tube located in the housing.
5. Remove shift cylinder adapter tube from housing. Discard O-rings from the adapter, if replacement is necessary.

D. PTO and Declutch Disassembly

The declutch assembly and PTO are essentially identical. Hereafter, reference will be made to the declutch only. For cases equipped with PTO, use the instructions for declutch disassembly, inspection and reassembly exactly as given.



1. Remove eight cap screws holding declutch carrier to declutch housing.
2. Tap carrier to loosen and withdraw carrier and output shaft assembly.
3. Unscrew indicator light switch from declutch housing and remove copper washers. Remove switch actuator pin from inside declutch housing using a magnet.
4. Remove four cap screws from declutch cover plate and remove cover plate.



5. Cut the lockwires and remove the shift fork clamping screws.

IV. TRANSFER CASE DISASSEMBLY

D. PTO and Declutch Disassembly (Cont.)

6. Remove four long capscrews from shift cylinder and lift off cylinder cap.
7. Withdraw shift piston and shift shaft as a unit.
8. Remove shift cylinder adapter tube and stop ring, discarding O-rings.
9. Remove nut from shift shaft and lift off the piston and spring, discarding O-rings and felt wiper.

NOTE: THERE IS NO SPRING IN THE SSPTO-160 CYLINDER.



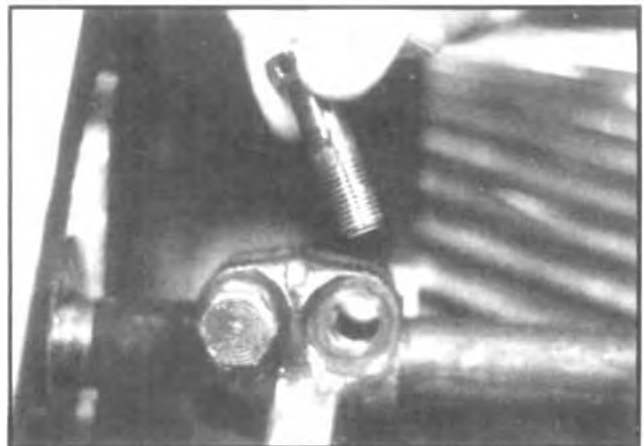
10. Withdraw shift fork and clutch collar.
11. There is no need to remove the declutch housing unless the part is to be replaced. If the main housing is to be disassembled, leave the declutch housing in place until instructed to remove by main case disassembly procedure.
12. Remove companion flange lock nut and washer from carrier and output shaft assembly, discarding nut. Use a new nut for reassembly. Slide companion flange off output shaft.
13. To press output shaft from declutch carrier and clutch gear, press against threaded end of shaft while supporting the clutch gear.
14. Remove output seal, bearings, and end play spacer from declutch carrier, discarding seal. Remove bearing cups from the declutch carrier, only if they are to be replaced.

E. Main Housing Disassembly

1. With case mounted on suitable stand, position with side cover up. (All references to front or back herein, are descriptive of the transfer case. For the Split-Shaft PTO-160, reverse all directions).



2. Remove side cover bolts and side cover.



3. **NEUTRAL ONLY:** Remove safety wire on shift fork clamp bolts and remove bolts. Pull shift shaft out of rear of case and remove shift fork from collar.

NOTE: SHIFT FORK AND COLLAR ARE NOT REVERSIBLE. NOTE ORIENTATION BEFORE REMOVING.

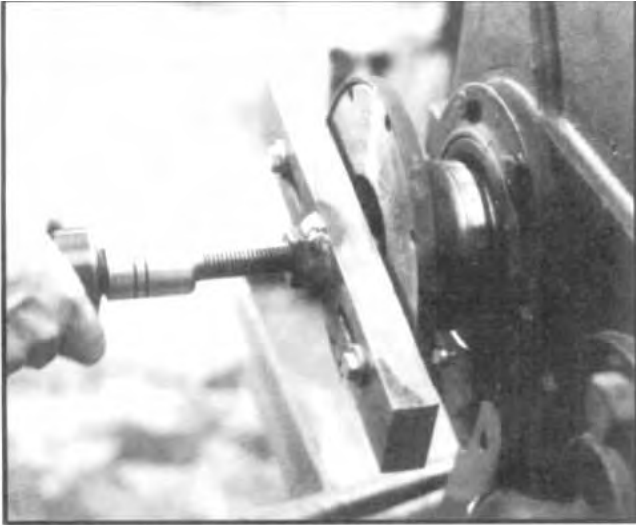
IV. TRANSFER CASE DISASSEMBLY

E. Main Housing Disassembly (Cont.)

4. Remove rear shift shaft adapter and front shift shaft cap and adapter.

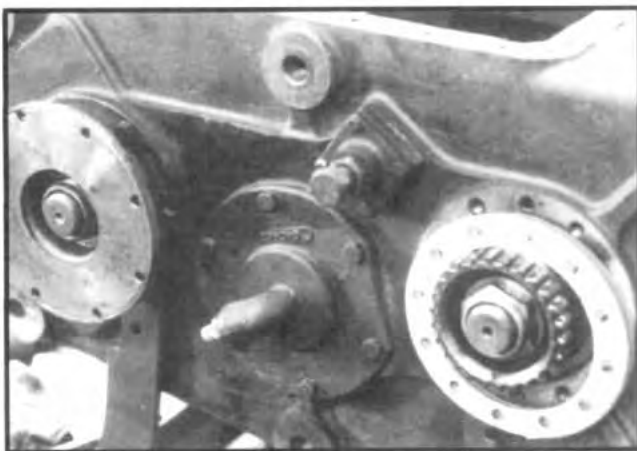
IMPORTANT: DO NOT ATTEMPT TO REMOVE THE BEARING CONE FROM THE SLEEVE (GEAR) UNLESS THE BEARING IS WORN OR DAMAGED AND THE SLEEVE (GEAR) IS REUSEABLE. SEE CAUTION NOTE ON PAGE 9, PAR. IV. A.5.

F. Main Shaft Removal



1. Remove input and output flange retainer nuts. Using a bar-type puller remove the flanges from the shaft and bearing.

WARNING: USE ONLY A BAR-TYPE PULLER AND DRAW UP BOLTS OR STUDS TIGHTLY TO FLANGE FACE. USE OF A JAW-TYPE PULLER WILL CAUSE THE FLANGE TO BEND OR OTHERWISE DAMAGE IT.



2. Remove the declutch housing (housings, if transfer case is equipped with a PTO). Remove the retaining nut on the blanking sleeve, (or declutch gear), and pull the sleeve (or gear) from the shaft. The bearing cone will come off with the sleeve.



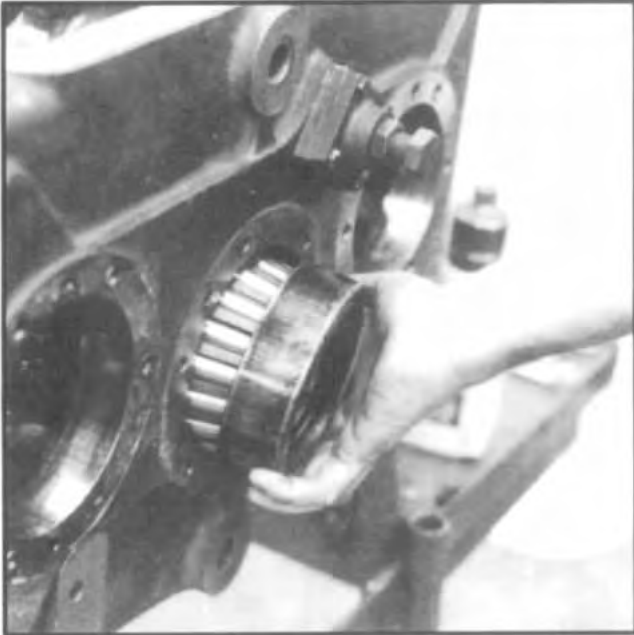
3. Pull bottom shaft out through the front opening of the case. Gear, spacer, shift collar and rear bearing will remain in case. The gear cannot be removed until the intermediate shaft gear is removed. The other parts can be retrieved later.
4. Remove the front input carrier. Pull the top shaft out of the top front opening in the same manner as the bottom shaft, except that the rear carrier (or PTO declutch housing), if present must be removed and the blanking sleeve (declutch gear) must be removed using a suitable puller. The bearing cone will come out with the blanking sleeve (or gear).

IMPORTANT: DO NOT ATTEMPT TO REMOVE THE BEARING CONE FROM THE SLEEVE (GEAR) UNLESS THE BEARING IS WORN OR DAMAGED AND THE SLEEVE (GEAR) IS RE-USEABLE. SEE CAUTION NOTE ON PAGE 9, PAR. IV. A.5.

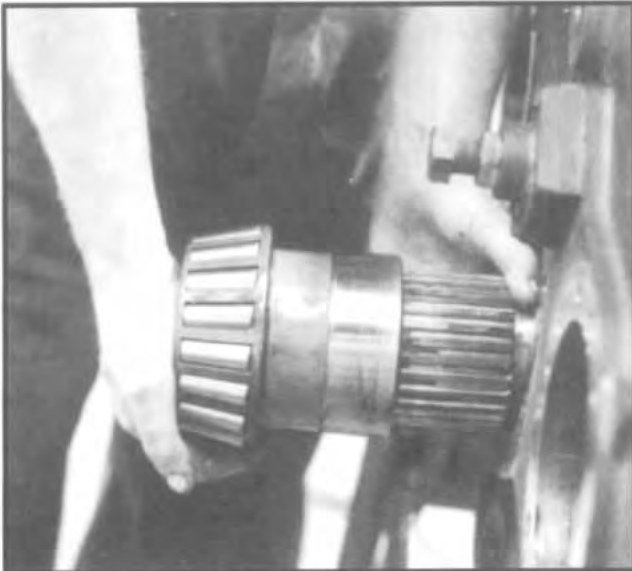
Remove the shaft out the front of the case, using a soft mallet to drive out the front bearing cup. Again, the parts will remain in the case to be retrieved later.

IV. TRANSFER CASE DISASSEMBLY

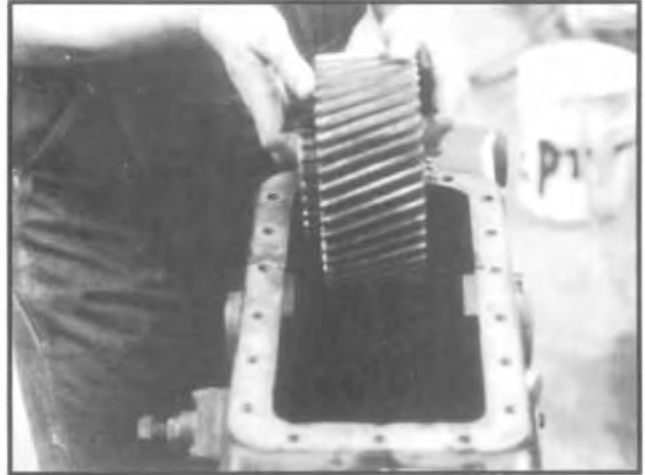
F. Main Shaft Removal (cont.)



5. Remove the front intermediate cap. Using a soft mallet and drive bar through the pump opening, drive the shaft forward until the bearing cup comes out.

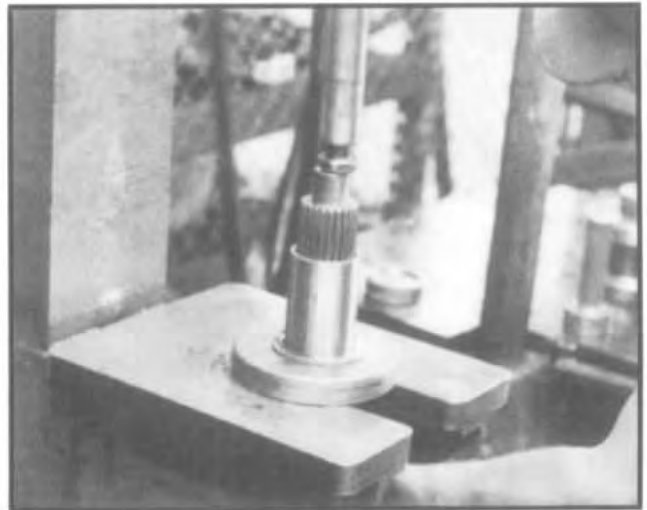


6. Continue to drive the shaft forward, taking precaution to support the shaft as it comes out.



7. Remove intermediate gear. Remove upper and lower gears and additional parts from case. Remove remaining cap and bearing assembly.

G. Shaft Disassembly



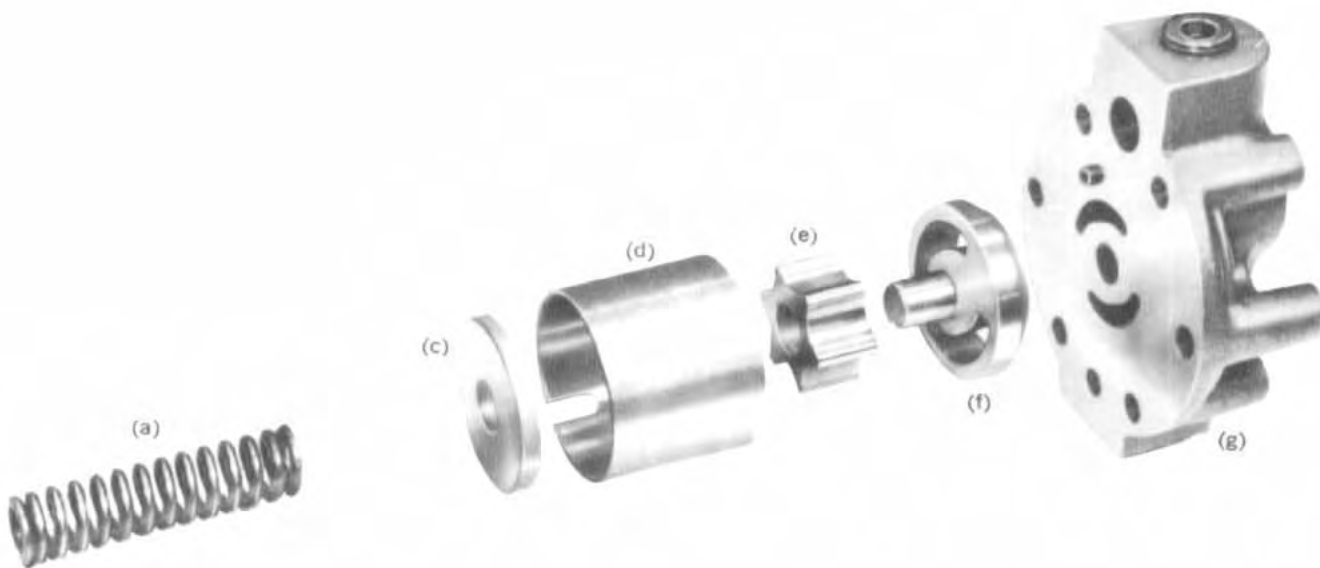
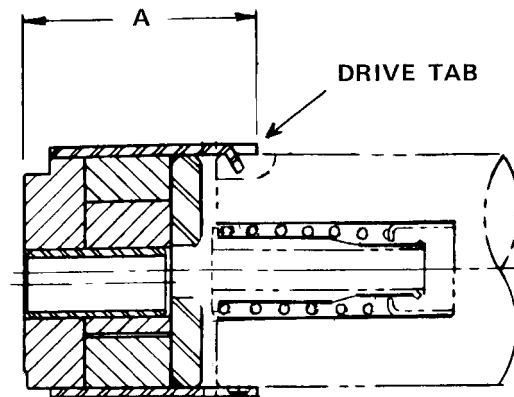
1. **BOTTOM SHAFT.** Remove declutch gear and bearing by tapping the shaft end thru with a soft hammer. Press thrust washer and bearing inner race off shaft.
2. **TOP SHAFT.** Remove clutch gear and front spacer washer from shaft and press the thrust washer and bearing sleeve off the shaft.
3. **INTERMEDIATE.** After driving the shaft out of the gear and rear bearing, the front bearing cone may be removed with a bearing separator.

IV. TRANSFER CASE DISASSEMBLY

H. Lubrication Pump Disassembly

1. The lubrication pump requires no further work for disassembly. When removed, the pump parts are free to separate for inspection and cleaning.
2. Wear cannot be detected by feel or play. Inspect the rotor, housing and idler for scoring. Inspect, particularly, the drive tab of the rotor assembly. If scoring is present, or the drive tab is notched, replace the pump cartridge assembly.

NOTE: THE PTO-160 HAS A LARGER CAPACITY PUMP, HAVING A THICKER ROTOR ASSEMBLY, THICKER SPACER, AND LONGER BOLTS. THE LARGE PUMP MAY REPLACE THE SMALLER BY CHANGING TO THE PTO-160 PUMP CARTRIDGE AND SPACER, USING LONGER BOLTS. THE PTO-160 PUMP SHOULD NEVER BE REPLACED BY THE SMALL TRANSFER CASE PUMP. THE TRANSFER CASE PUMP CARTRIDGE IS APPROXIMATELY 1-5/8" LONG ("A" DIMENSION); THE PTO PUMP CARTRIDGE IS APPROXIMATELY 2" LONG.



(a) spring (c) floating plate
(d) rotor assembly (e) idler (f) idler carrier (g) cover

V. CLEANING AND INSPECTION

A. Choice of Cleaning Methods

1. Steam may be used for external cleaning of completely assembled units. Care must be taken to ensure that water is kept out of the assembly by tightly closing breather caps and other openings.
2. Rough parts such as the housing, which are too large to conveniently clean with solvents, may be immersed in a hot solution tank containing a mild alkaline solution. Parts cleaned in hot solution tanks must be rinsed thoroughly to prevent damage by traces of alkaline material.
3. Parts with ground or polished surfaces, such as bearings, gears, and shafts, should be cleaned with emulsion cleaners or petroleum solvents. Alkaline hot solution tanks may damage the machined surfaces and such cleaning methods should be avoided.

B. Drying and Corrosion Inhibition

Soft clean shop towels should be used to dry parts after cleaning. Compressed air may be used to clean inaccessible areas of large parts such as the housing. Bearings should not be spun dry with compressed air, as the lack of lubrication may cause damage to the mating surfaces.

Dried parts should be immediately coated with a light oil or corrosion inhibitor to prevent corrosion damage. Parts which are to be stored should also be wrapped in heavy waxed paper.

C. Inspection

Prior to reassembly, parts which are to be reused must be carefully inspected for signs of wear or damage. Replacement of such parts can prevent costly downtime at a future date.

All bearing surfaces, including roller bearing cups and cones, should be examined for pitting, wear, or overheating. Gears also may show pits, as well as scoring and broken teeth. Shafts may be nicked or marred, or may have damaged threads. Parts which show any signs of damage should be repaired or replaced.

Check all shift forks and slots in sliding clutches for extreme wear or discoloration from heat. Check engaging teeth of sliding clutches for partial engagement pattern.

VI. TRANSFER CASE ASSEMBLY

A. General Precautions for Reassembly

IMPORTANT: Read this section before starting reassembly procedure.

Make sure that the interior of the transfer case is clean. It is important that dirt be kept out of transfer case during reassembly. Use certain precautions, as listed below, during reassembly.

1. Gaskets — Clean all gasket surfaces of past gasket material. Use new gaskets throughout the transfer case as it is being rebuilt.
2. Bolts — To prevent oil leakage, use Permatex Form-A-Gasket #2 pliable setting sealant or equivalent on all threaded holes drilled through the housing. See torque specifications for recommended torque, Section VII.
3. Assembly — Refer to the views in the parts manual as a guide to reassembly.
4. Initial Lubrication — Coat all thrust washers, splines and seals with lubriplate during installation to provide initial lubrication, preventing scoring and galling.
5. Bearings — Press or drive bearing races by applying force to inner race or outer race, whichever is being installed.
6. Universal Joint Companion Flanges -- Pull the companion flanges tightly into place with the locknuts (old locknuts may be used for pulling, then replaced with new); tighten to proper torque. If the flange is not pulled tightly into place, the bearings will not seat properly, causing erroneous end play readings and possible damage to bearings, shafts, and gears.
7. Inspect all spacer washers and rings for wear. The width or thickness of each spacer washer or ring has been noted in the assembly procedures and each spacer should be measured with a micrometer for proper size. Worn spacers should be replaced.

IMPORTANT

8. Early TC & PTO-160 had a splined intermediate shaft and gear. (See Parts Manual, Page 35, Note @.) An intermediate design had pilot rings shrunk onto the shaft and in the gear. Current production has a keyed shaft and gear. Disassembly and assembly descriptions are still the same as for the splined shafts.

B. Shaft Assembly



1. **Intermediate Shaft.** Heat the front bearing cone in 350 degree oven and drop over shaft (short journal), insuring that the bearing race bottoms against the shoulder.



THICKWALLED SPACER--
TOP SHAFT (& BOTTOM
SHAFT W/O NEUTRAL)



THIN BEARING RACE--
BOTTOM SHAFT W/
NEUTRAL

2. **Top and Bottom Shafts:** Shafts, thrust washers, and the thick-walled (3-3/8 in. O.D.) spacer are identical, when the case has no neutral shift. With the neutral shift option, the bottom shaft will have a thin-walled (3 in. O.D.) spacer pressed on instead of the thick-walled one.

VI. TRANSFER CASE ASSEMBLY

B. Shaft Assembly (cont.)



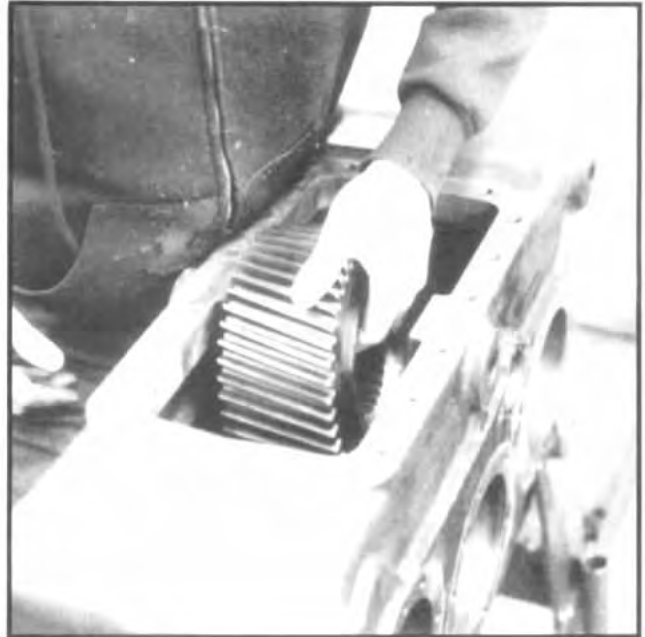
3. Install the thin (5/32 or .150 thk.) thrust washer against the shoulder of the shaft (long journal), with oil groove facing away from the shoulder. Heat race (sleeve) in 350° oven and drop over the shaft.



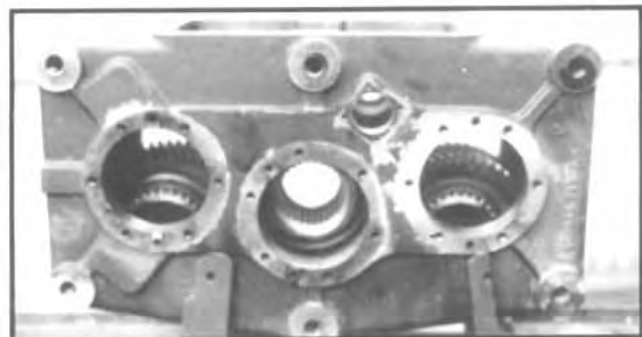
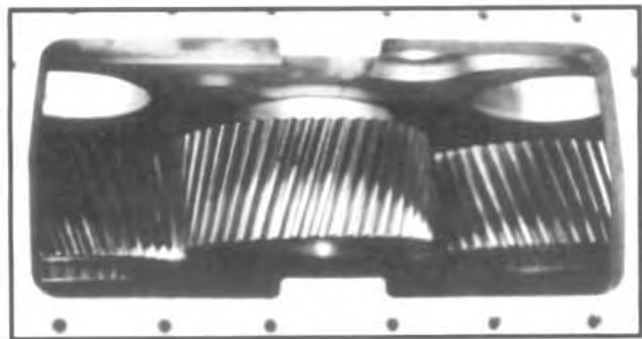
4. The shaft with the thick-walled sleeve will then be the top one, while the one with the thin-walled race will be the bottom shaft (with neutral).

C. Installation into Housing

1. Upper and lower gears are identical.



2. Place both gears in the case, lying on the bottom of the housing side by side. Orient clutch gear teeth toward front of case.

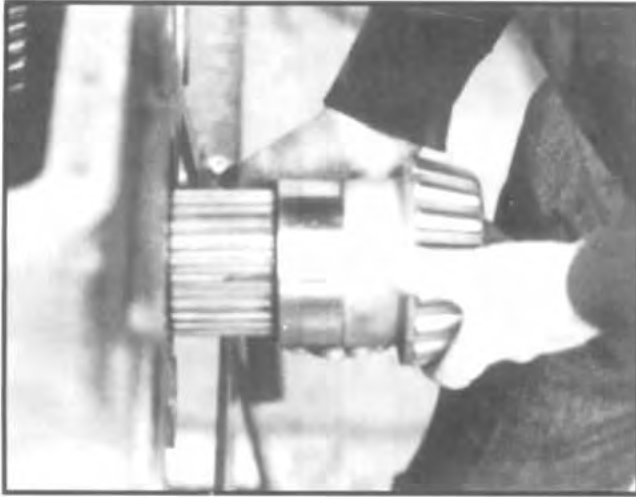


3. Place intermediate gear in case, between the upper and lower gears. Supporting the intermediate gear on the upper and lower gears, align the gear bore with the case bore approximately, keyway to top.

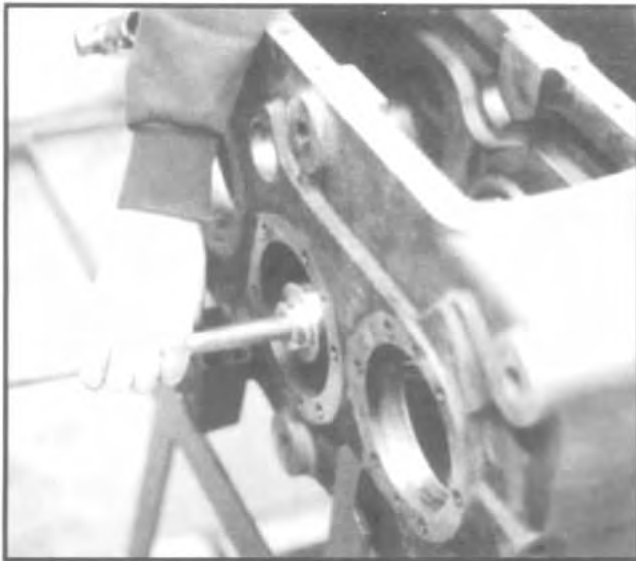
VI. TRANSFER CASE ASSEMBLY

C. Installation into Housing (cont.)

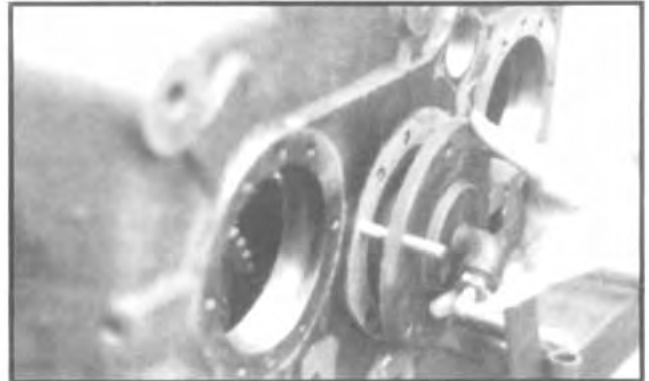
4. Tap the key down into the keyway of the shaft. The shaft has a small undersized starting journal to allow starting the shaft into the gear bore, and then align the key into the gear keyway.



5. Using a soft hammer, from the front of the case, drive the shaft into the gear.



6. It is extremely helpful (and beneficial to fingers) to insert a round bar into the pump spring hole to assist in supporting and guiding the shaft into the gear bore and keyway.



7. Insert front bearing cup into housing and install gasket and front intermediate cap.



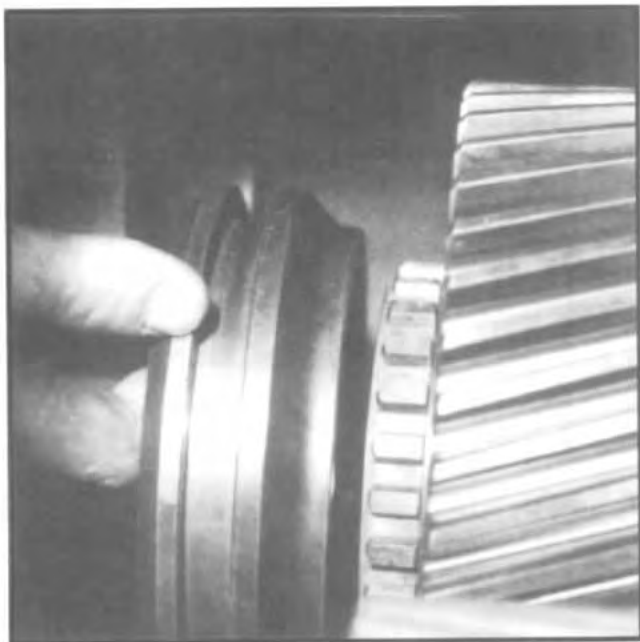
8. Heat the rear bearing cone to 350° in an oven. Install the cone onto the rear shaft, insuring that it is seated against the gear shoulder. Insert the rear bearing cup and install the cap with two bolts torqued lightly (about 15-20 lb. ft.). This holds the rear bearing cone in place until it cools and the shrink fit has set, insuring that the bearing race does not move from its seat position, giving correct end play readings. The end play will be set later.

VI. TRANSFER CASE ASSEMBLY

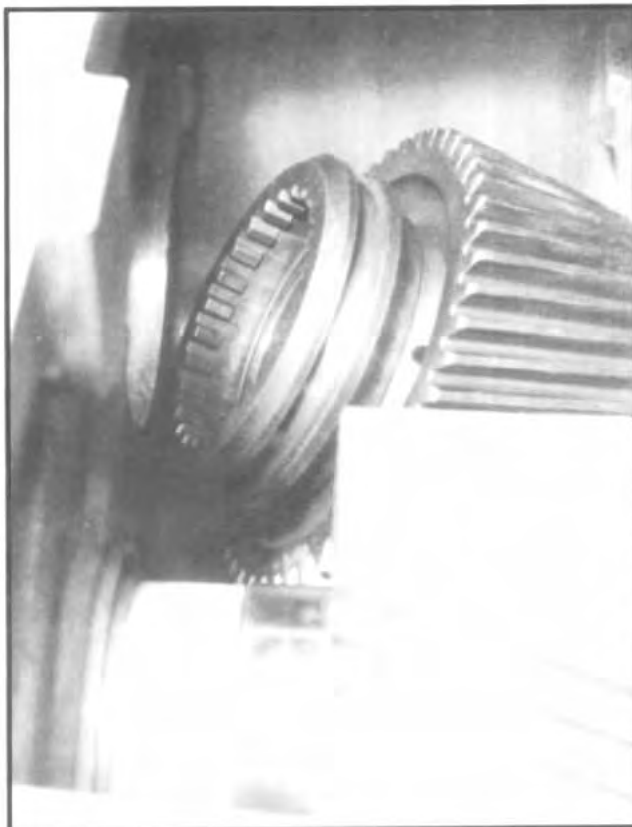
C. Installation into Housing (cont.)



9. Top Shaft. Install wire ring inside the clutch collar.



10. Install the collar over the clutch teeth on the upper gear with the short hub of the collar facing the gear.



11. Tilt the gear in the case so that the opening points upward approximately in line with the housing bearing bore.



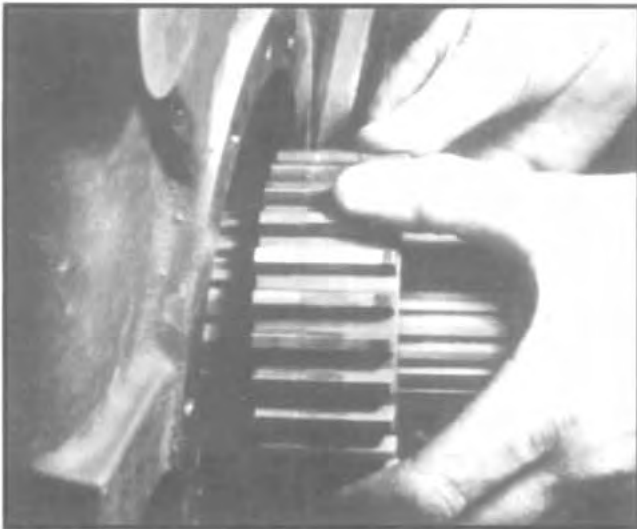
12. Insert the shaft (with the heavy wall sleeve) into the gear bore.

VI. TRANSFER CASE ASSEMBLY

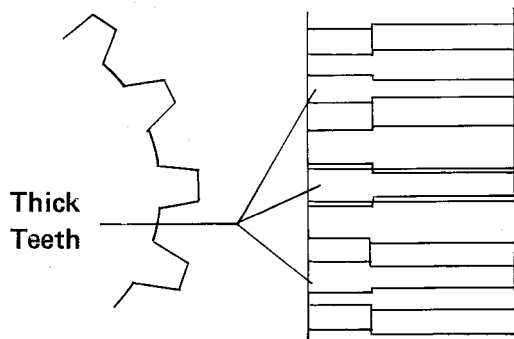
C. Installation into Housing (cont.)



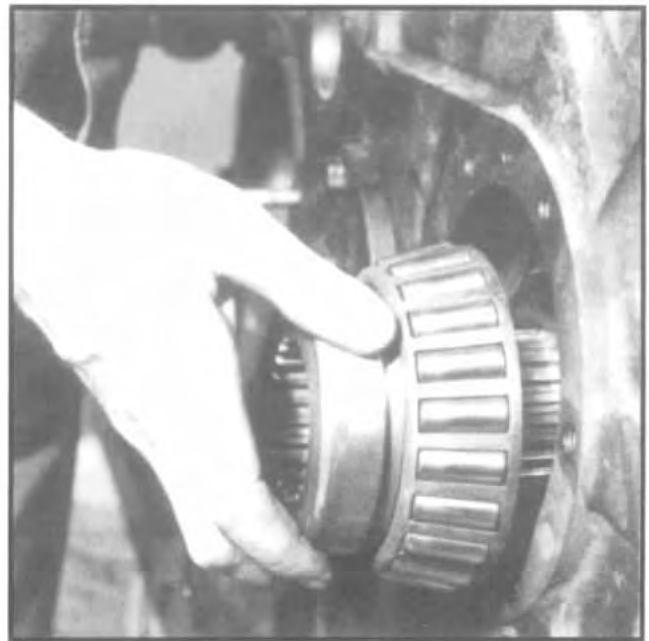
13. Lift the rear of the shaft, straightening the gear and shaft assembly in relation to the case, and support the rear of the shaft in the rear housing bearing bore.



14. Install a clutch gear on the front shaft spline, making sure that the end with the thick teeth goes inside the clutch collar.



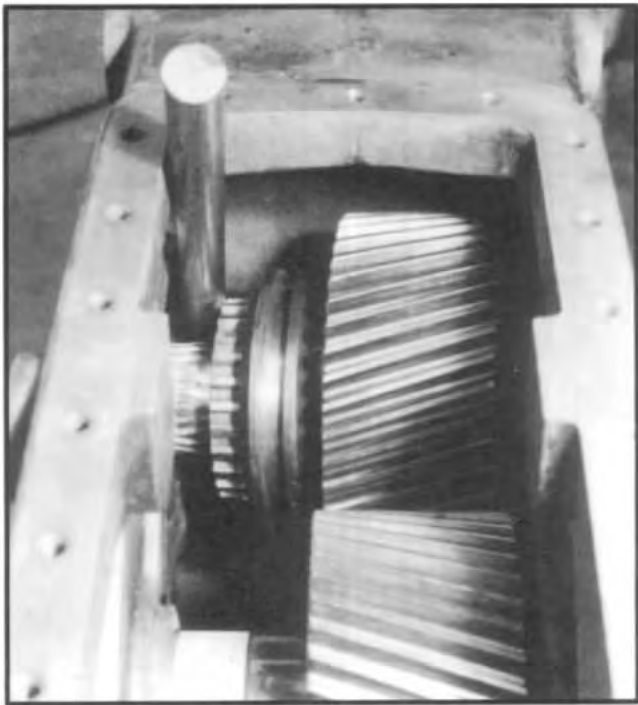
15. Install the 5/8 (.625) thick thrust washer (with oil groove) on the rear of the shaft, oil groove facing the gear, and support the washer in the housing bearing bore. This will provide clearance for bearing installation.
16. If the rear bearing and blanking sleeve (declutch gear if PTO equipped) have been separated, a new bearing must be installed. Heat bearing cone to 350° in an oven and drop over blanking sleeve



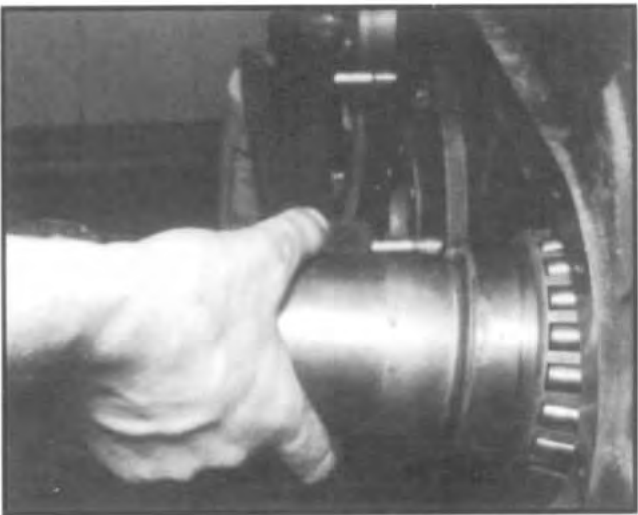
17. Install cone and sleeve assembly over rear splines and start to drive on with a soft hammer.

VI. TRANSFER CASE ASSEMBLY

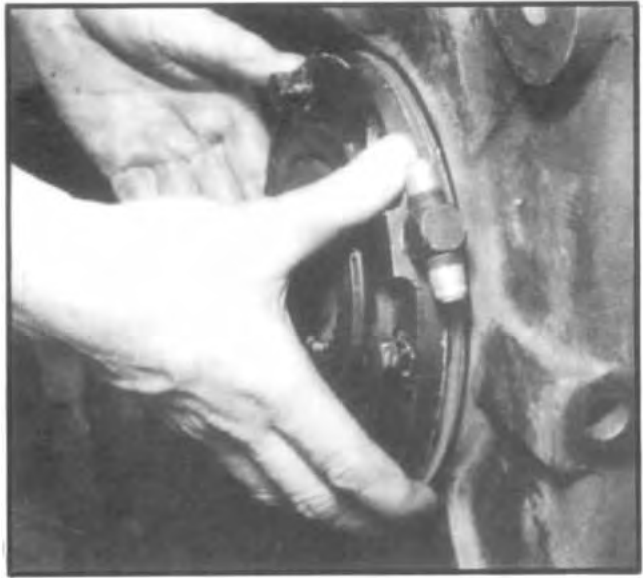
C. Installation into Housing (cont.)



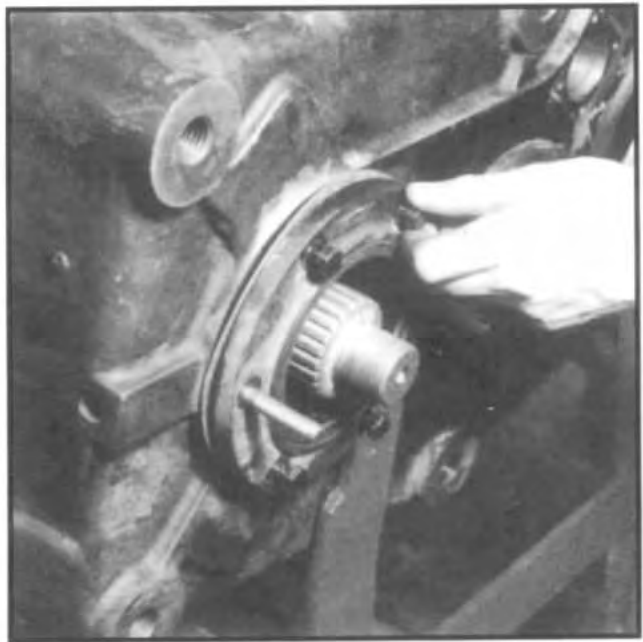
18. After splines are started, lift bearing up into housing bore, place a bar between the clutch gear and the inside front of the housing to prevent the shaft from being driven out the front, and drive the sleeve and thrust washer into place against the shoulder of the gear.



19. Install a thick (3/8 in.) plain washer on the front of the shaft and support the shaft in the front bearing bore. Install the rear bearing cup in the bore and drive in flush with the surface of the housing.



20. Install rear carrier temporarily with bolts and flat washers, torqued lightly. Install front bearing cone loosely on shaft and insert cup, driving into place with a soft hammer.



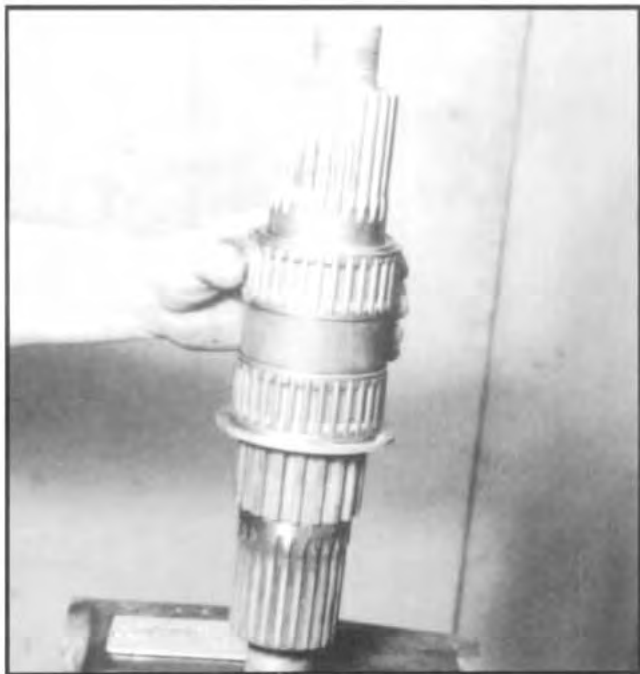
21. Install gasket and front carrier (with seal installed), making sure that oil holes in housing and oil grooves in carrier line up. Install bolts and flat washers and torque to specification.

VI. TRANSFER CASE ASSEMBLY

C. Installation into Housing (cont.)



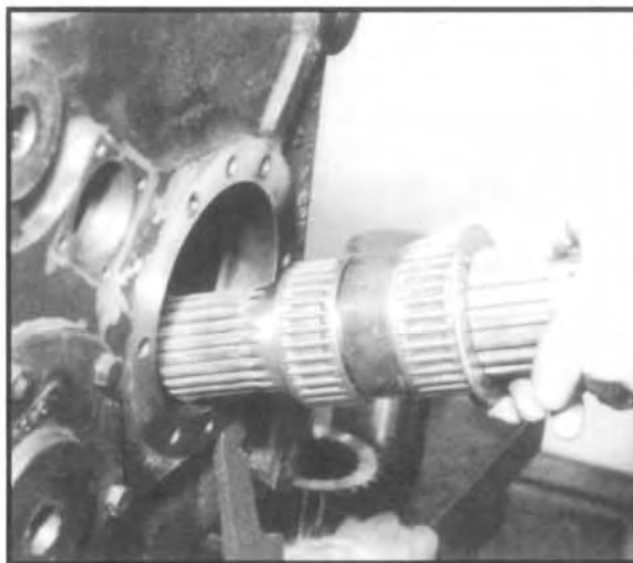
22. Grease seal lips and start front flange onto splines. Flange must be lifted up to start hub into bearing bore. Drive flange on with a soft hammer until seated. Install nut and washer and torque to specification.



23. **Bottom Shaft, With Neutral:** Install needle bearing assemblies on remaining shaft (with thin-walled bearing race). Place a bearing spacer (approx. 3 in. O.D. x 1-1/8 lg.) between the cages.



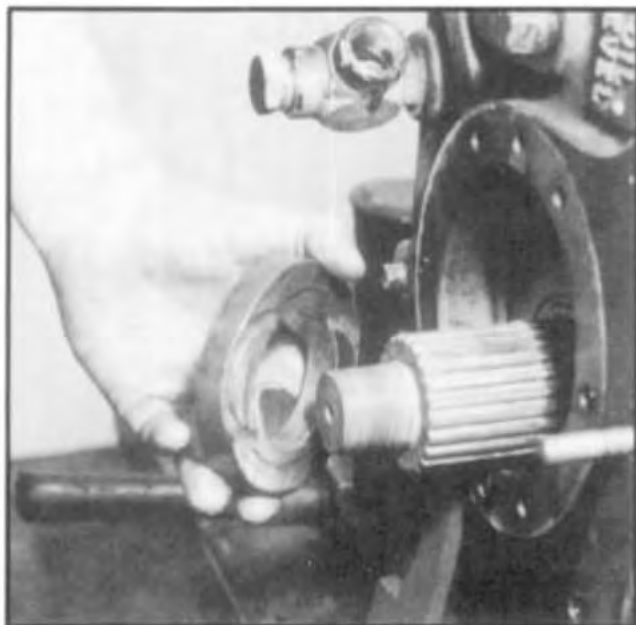
24. Pre-lube the needle bearings with grease.
25. **Without Neutral:** Install a wire ring inside the clutch collar, as on the top shaft (See VI. C.9, p.19).
With Neutral: No wire ring is used. (The SSPTO always has neutral.)
26. Install the shift collar (oriented as on the top shaft, see VI. C.10, p.19) onto the gear clutch teeth.



27. Tilt the gear and collar in case as on the top shaft assembly. Insert shaft and bearings through gear bore. Lift rear end and straighten gear and shaft, supporting shaft ends in housing bores. Install clutch gear over splines on shaft, with thick teeth inside the collar as on top shaft. (See VI, C. 14, p. 20).

VI. TRANSFER CASE ASSEMBLY

C. Installation into Housing (cont.)



28. Install the 5/8 (.625) thick thrust washer (with oil grooves) on the rear on the shaft with oil grooves facing the gear. Install the 3/8 (.375) thick plain thrust washer on the front of the shaft.



29. If the bearing and declutch gear have been separated on disassembly, a new bearing must be installed.



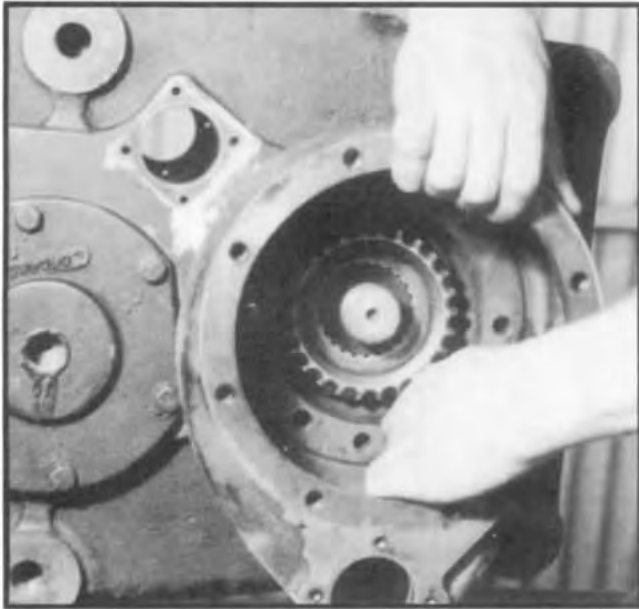
30. Install bearing and gear assembly onto front of shaft, starting the splines.



31. Lifting the shaft to allow bearing to go into bore, push the gear against the inside of the housing at the rear and drive the declutch gear until seated against the washer and shaft shoulder.

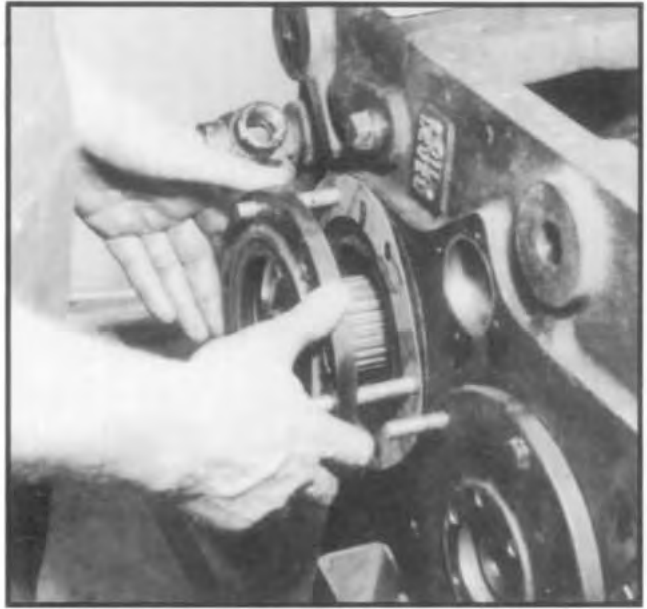
VI. TRANSFER CASE ASSEMBLY

C. Installation into Housing (cont.)

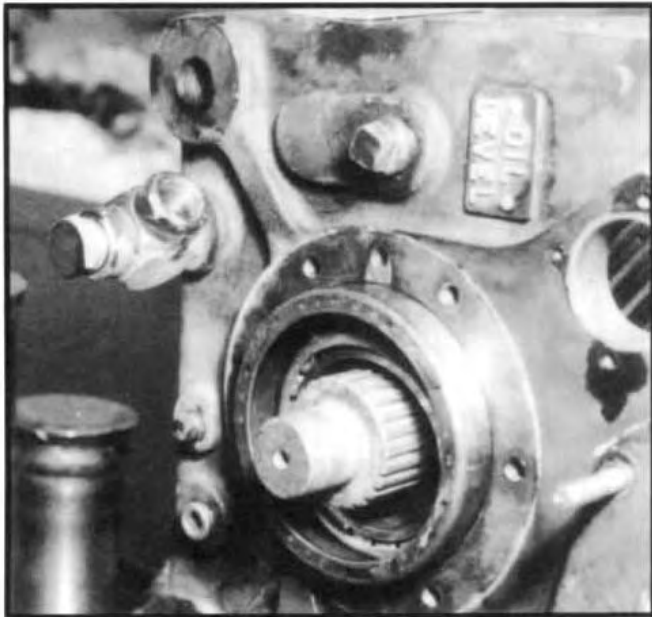


32. Insert the front bearing cup into the housing bore and drive in flush. Install declutch housing and bolt in place with two bolts to hold the cup while installing output flange.

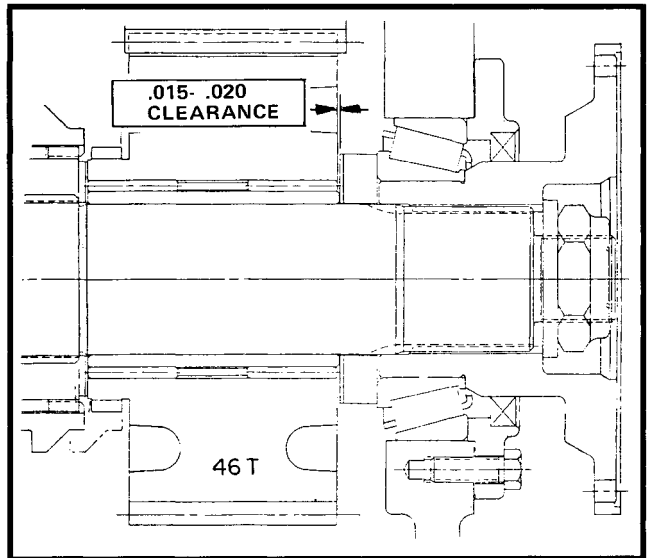
As on the top shaft, install nut and washer on the declutch gear and torque to specification.



34. Install rear carrier (with seal) and gasket, aligning oil holes and grooves, install bolts and torque to specifications.
35. Following the same procedure as in installing the front input flange (VI. C.22), install the rear output flange.



33. Install rear bearing cone loosely on shaft and install cup into housing, driving in flush.



36. **NEUTRAL ONLY:** Check the clearance between the **bottomshaft gear face and the thrust washer**. The clearance should be between .015 and .020 inch. If it is more than .020, the gear and thrust washer should be inspected for wear and replaced if necessary.

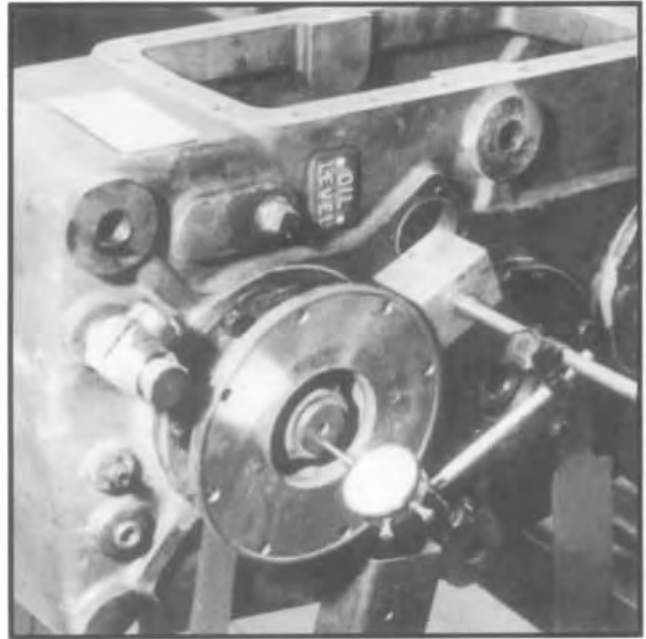
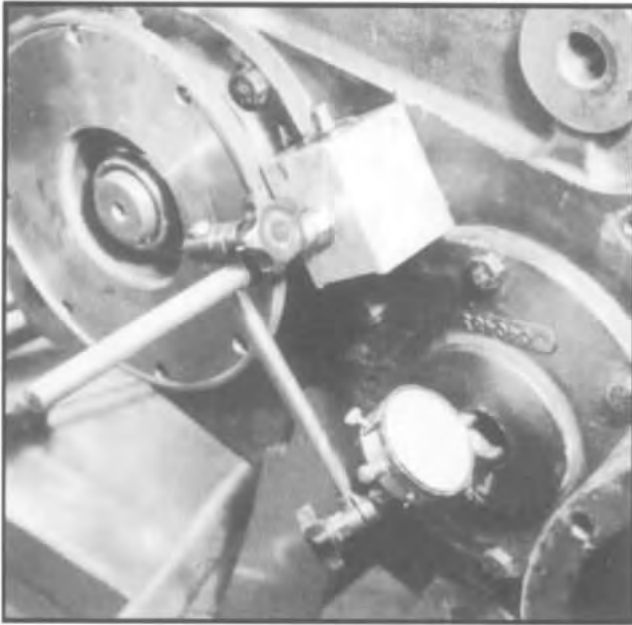
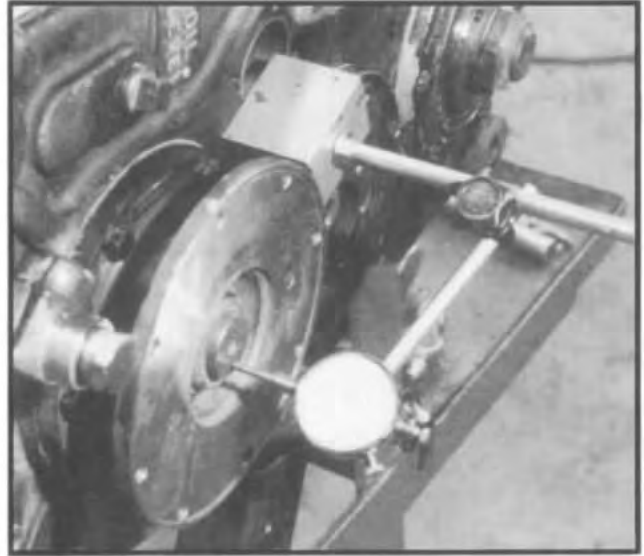
VI. TRANSFER CASE ASSEMBLY

D. Shimming Shafts

The top and intermediate shafts are shimmed at the rear of the housing (PTO-160, front); the bottom shaft is shimmed at the front (under the declutch housing). (The PTO-160, rear.)

1. **Intermediate.** Bottom the bearing cup by driving the rear cap against the shaft and bearing assembly. Measure the gap between the lip of the cap and the housing surface with a feeler gauge, add 3 to 8 thousandths (.003 - .008) to the measurement and select shims to add up to this thickness.

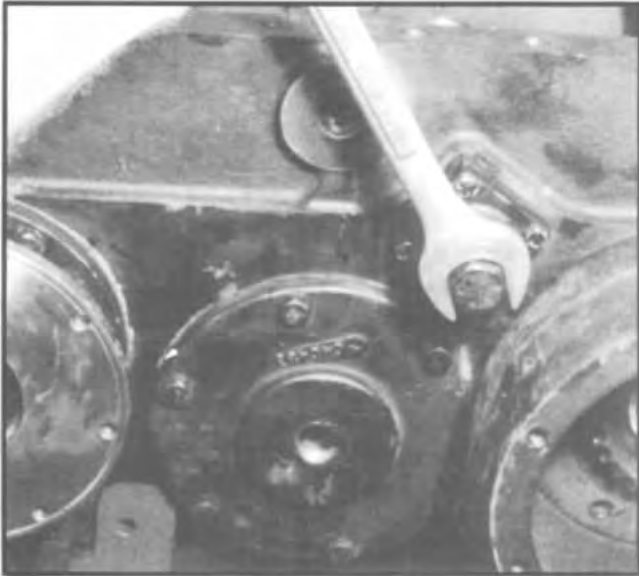
EXAMPLE: GAP MEASURES .164; ADDING .003-.008 GIVES .167-.172. USE FIVE .030 SHIMS WHICH MAKE .150, PLUS ONE .015 AND ONE .005 TOTALING (.150 + .015 + .005 =) .170, WHICH FALLS WITHIN THE RANGE.



2. Remove cap, add shims, replace cap and bolts and torque to specification. Set a dial indicator on front cap with contact point through the vent hole onto the shaft end. Using a pry bar, pry the gear back and forth, reading the indicator needle movement. The indication should be .003 - .008 end play. If not obtained, remove cap and remove or add shims until the proper reading is obtained.
3. **Top and Bottom Shafts.** The top and bottom shafts are shimmed exactly as the intermediate with the exception that with a PTO option, the top shaft uses a housing at the rear instead of a carrier to retain the bearing race, and the bottom shaft always has a housing at the **front** of the case where shimming is done. (Rear, on the PTO-160.)

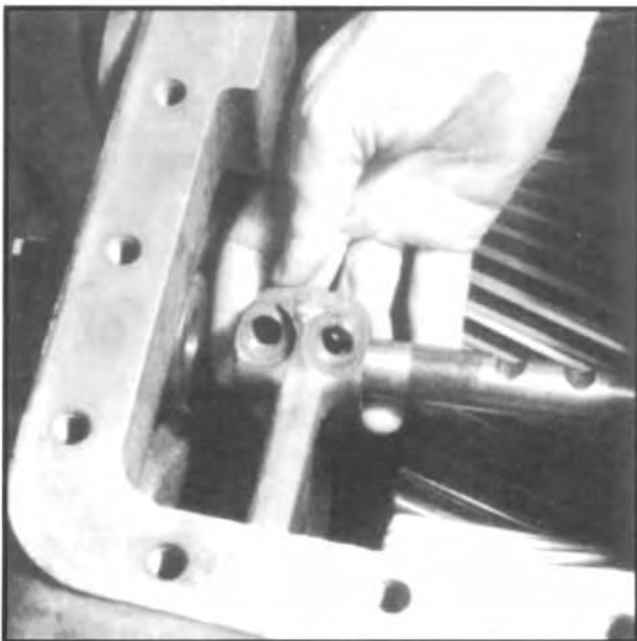
VI. TRANSFER CASE ASSEMBLY

E. Shift Cylinder Assembly and Adjustment (Neutral Only)

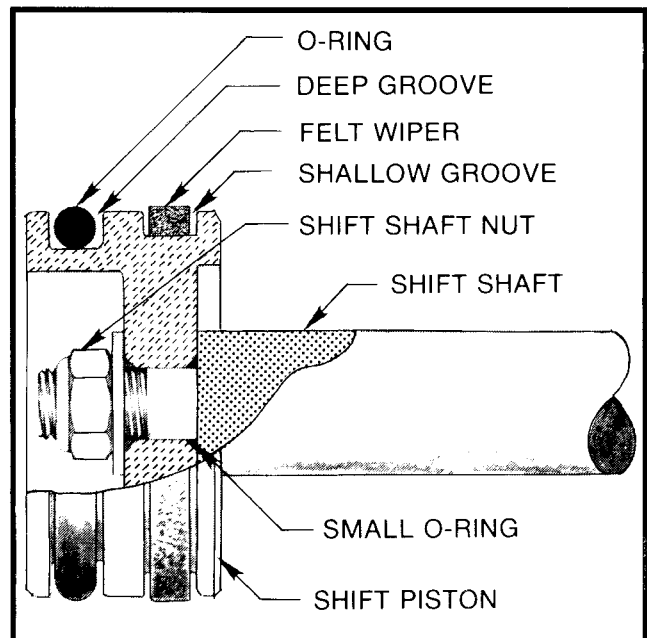


1. Install front adjustment cap assembly and gasket, if removed. Lubricate the O-ring in the carrier before insertion. Install four bolts and torque to specification.
2. Lubricate the O-ring on the shaft cylinder adapter and install in case.

PTO-160 — LUBRICATE THE INSIDE O-RING AS WELL AS THE OUTER ONE.



3. Install the shift fork in the shift collar. The flat side of the fork should be toward the front of the case (away from the shift cylinder) and the clamp bolts should install straight into the holes. The clamp bolt heads should be on the open side of the case when installed, easily accessible for torquing and safety wiring.
4. Insert the shift shaft through the cylinder adapter, into the fork and the rear carrier, lining the shaft grooves up with the bolt holes. Install the shift fork clamping screws, tighten per specification, and install lockwire.
5. Place the spring into the cylinder adapter over the shaft. (The SSPTO-160 does not use the spring.)



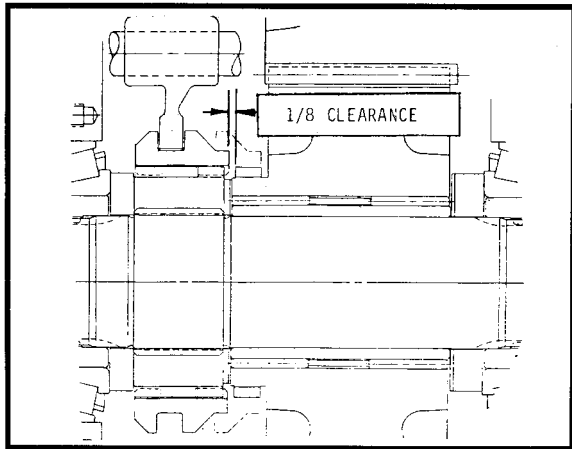
6. Install small O-ring over the threaded stud at the end of the shaft, install piston as shown with the shallow groove side toward the shaft shoulder.
7. Install nut and washer, tightening to specification.
8. Place an oil-soaked felt wiper into the shallow groove of the piston and a large O-ring into the deep groove.

NOTE: Since it takes some time to soak the felt wiper long enough to expand and soften enough to fill the groove it is a good idea to do this ahead of time. Also, the felt wiper will not necessarily fill the groove the entire circumference of the piston.

VI. TRANSFER CASE ASSEMBLY

E. Shift Cylinder Assembly and Adjustment (Neutral Only) (cont.)

9. Coat the piston, O-rings and adapter with oil or lubriplate and push the cylinder over the piston and over the adapter. SS PTO ONLY: Install a plastic stop ring in the cylinder between the piston and the cap.
10. Install O-ring in cylinder cap, lubricate and install into cylindertube end using four long cap screws. Torque to specification, tightening evenly to avoid cocking of the cylinder cap.



11. ADJUSTING THE NEUTRAL.

WITH COVER OFF: Loosen the jam nut. Apply air to the cylinder to push the fork and collar to the neutral position. Check for 1/8 inch of clearance between the collar lip and the teeth on the large gear. Adjust the bolt in or out, as needed, to obtain the required clearance. Tighten jam nut.

WITH COVER IN PLACE: Loosen the jam nut, screw stop bolt in until it bottoms out on the shaft end. Apply air to the cylinder. Back off stop bolt, until the rear output shaft turns freely without tooth clatter or noise. Back the stop bolt off two additional full turns and lock the jam nut. This procedure gives the 1/8 inch clearance.

F. PTO and Declutch Assembly

1. Bolt PTO/declutch housing and gasket to main case with six capscrews. Be sure to align oil passages. Tighten capscrews to correct torque.



2. Slide clutch collar into the shift fork ears and assemble the two parts together into the declutch housing. The short hub on the collar **must face the housing** and the flat side of the fork **must face away from the housing**. The shift fork is not symmetrical and it is possible to install it backward. Even if the shaft and adapter will assemble, the fork will interfere with the inside of the declutch housing and cause incomplete or erratic shifting.

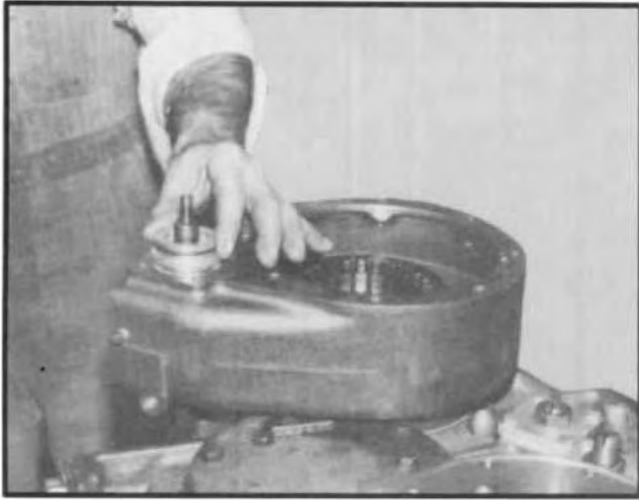


3. Install shift shaft through shift fork and into declutch housing. Align two grooves in shaft with clamping screw holes.
4. Install two shift fork clamping screws and tighten to correct torque. Secure clamp screws with lockwire.

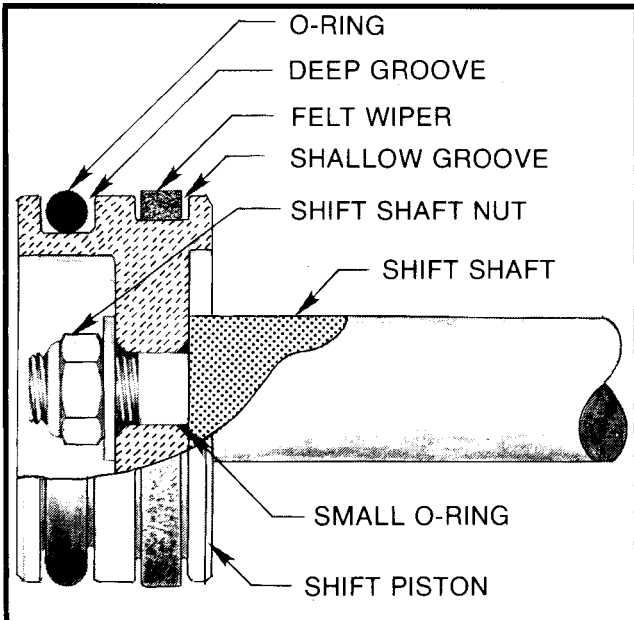
NOTE: If the clamping screws are not easily accessible through the side cover as shown, the fork is installed backward.

VI. TRANSFER CASE ASSEMBLY

F. PTO and Declutch Assembly (cont.)



5. Install O-rings in adapter tube and insert adapter tube into declutch housing.

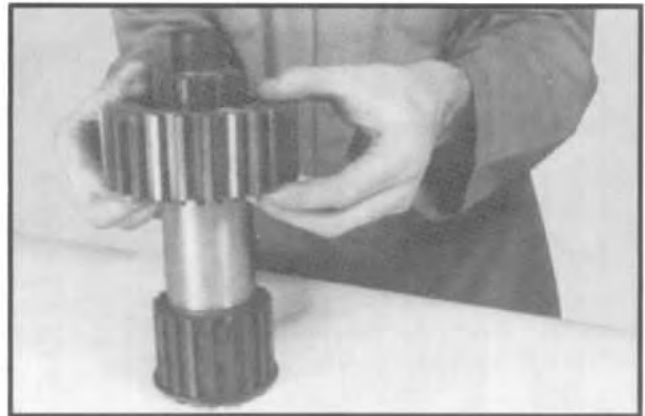


6. Place small O-ring over threads of shifter shaft.
7. Place stop ring over shift shaft and place spring over end of shift shaft.
8. Place piston over threads of shift shaft (depressing spring) with shallower of two grooves facing towards shaft.
9. Install shift shaft nut and washer. Tighten nut to correct torque.
10. Place an oil soaked felt wiper in shallow groove on piston and an O-ring into deep groove.

NOTE: Since it takes some time to soak the felt wiper long enough to expand and soften enough to fill the groove it is a good idea to do this ahead of time. Also, the felt wiper will not

necessarily fill the groove the entire circumference of the piston.

11. Coat the shift cylinder tube lightly with gear lubricant. Place cylinder tube over piston and over adapter tube. (Use care not to cut or displace O-rings.)
12. Install O-ring in shift cylinder cap.
13. Install cylinder cap on cylinder tube with four long capscrews, tightening to correct torque. Tighten capscrews evenly to prevent cocking the cylinder cap.
14. Apply cover plate gasket to declutch housing.
15. Install cover plate with four capscrews, tightening to correct torque.
16. Insert plunger into indicator switch hole with rounded side of plunger against the shift shaft.
17. Install indicator switch, shimming with copper washers as necessary for proper operation. Check with continuity indicator.
18. Press bearing cups into declutch carrier.



19. Install snap ring on output shaft and slide clutch gear onto output shaft. Flat side of gear to face up.



20. Press roller bearing onto output shaft and insert declutch carrier onto output.

VI. TRANSFER CASE ASSEMBLY

F. PTO and Declutch Assembly (cont.)

21. Place end play spacer through front of declutch carrier and on top of inner roller bearing.
22. Press outer roller bearing onto output shaft and into declutch carrier.

NOTE: The declutch and PTO output shaft bearings need no adjustment as the bearing spacer is factory selected for proper end play. If the bearings, carrier, shaft or clutch gear have been replaced, the end play should be reset, the shaft and carrier should be assembled with the bearings and output flange and checked with a dial indicator as in setting the main shaft's end play. End play should be .003 to .008 inch.

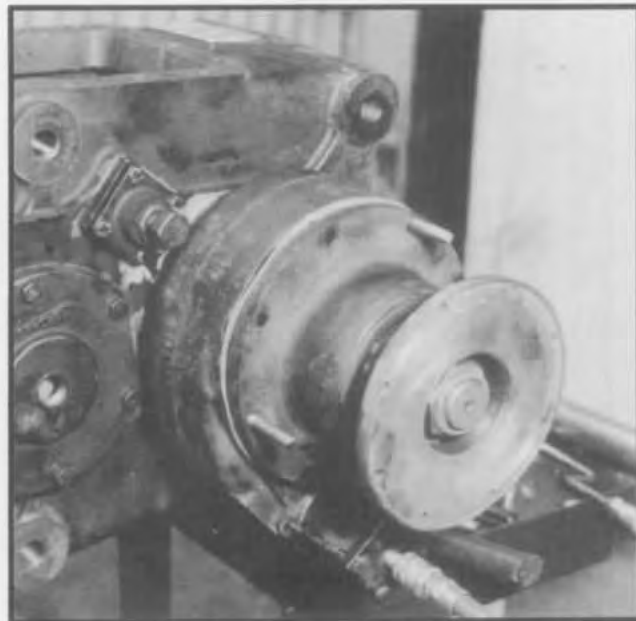
The front and rear axle outputs are identical but use a different shaft and bearings from the PTO outputs, whether on the TC or SSPTO, and consequently, the bearing spacers are different.

The front or rear axle output shaft will be set to correct end play by using a .370 spacer most of the time. Spacers are available in .005 in. increments from .360 to .385.

The PTO output shaft will use a .323 spacer most of the time, with other thickness of .313 to .328 available.

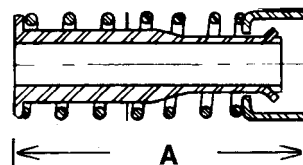
When setting new bearings or parts, use the above listed spacer thickness for the first attempt, and, nearly every time, disassembly and re-spacing will not be necessary.

23. Install drive flange seal with an appropriate driver.
24. Coat the flange hub with gear lubricant. Install drive flange onto output shaft with nut and lockwasher. Tighten nut to correct torque.



25. Apply gasket to housing assembly and install declutch carrier with eight capscrews, tightening to correct torque. Declutch carrier must be installed so oil seal drain passage is to the bottom of the case.

G. Oil Pump Assembly and Installation

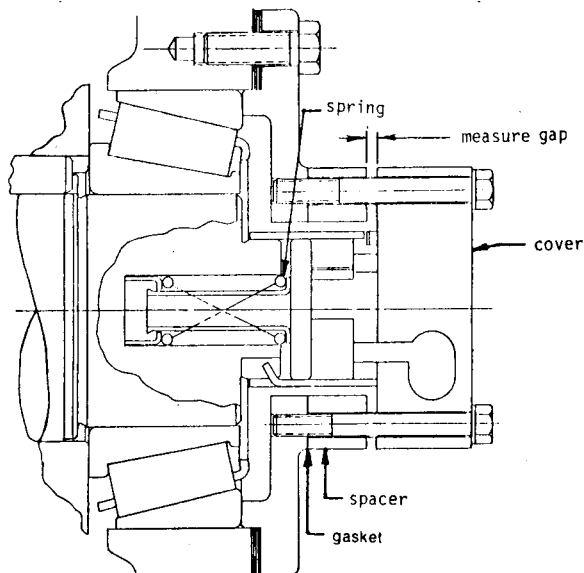


1. Measure the spring free length, A, before installing the spring in the shaft. Use this dimension to calculate the amount of shim required.
2. Install the spring into the shaft recess, cup first (see picture). Install pump cartridge assembly over shaft pilot, with the drive tang in the slot. Install the gasket, spacer and the cover. Start two bolts in part way to guide and hold the cover and spacer. Hold the spacer against the cap solidly, hold the cover firmly against the spring without compressing it and measure the unshimmed gap between the cover and the spacer.
3. The free length of the spring, A, should be 2-1/4 to 2-9/32 inches. For proper pressure relief, the compressed length of the spring should be 2-1/8 inches, and the cover-to-spacer gap must be

VI. TRANSFER CASE ASSEMBLY

G. Oil Pump Assembly and Installation (cont.)

shimmed to make the spring this length when the bolts are tightened down. The gap width, after adding shims, must be the same dimension as the difference between the free length, A, and 2-1/8 inches. After measuring the free length, A, subtract 2-1/8. Subtract this difference from the **unshimmed** gap measurement; the result is the total required shim thickness. Divide by .030 (or 1/32) to obtain the number of shims required.



EXAMPLE: SPRING FREE LENGTH, A = 2-9/32
UNSHIMMED GAP = 3/16

2-9/32 MINUS 2-1/8 (4/32) IS 5/32.

THE SPRING MUST BE COMPRESSED 5/32 TO THE PROPER DIMENSION OF 2-1/8 INCHES.

3/16 (6/32) MINUS 5/32 = 1/32 INCH
TOTAL SHIM THICKNESS.

EACH SHIM IS 1/32 (.030) THICK.

$1/32 \div 1/32 = 1$ SHIM

IF ANY TOTAL SHIM THICKNESS COMES OUT WITH ONE HALF OF A SHIM OR MORE, ADD A SHIM.

Install bolts and torque to specification.

VII. TORQUE SPECIFICATIONS

Location	Bolt Size	*Torque (lb.-ft.)
Air shift cylinder attach bolts	1/4 - 20	12
Declutch housing inspection plate bolts	1/4 - 20	10
Declutch to case bolts	7/16 - 14	60
Front drive/PTO/pump carrier unit and all end cap bolts	7/16 - 14	60
Access cover bolts	7/16 - 14	60
PTO flange retaining nut	1-1/4 - 18	400
Input, output flange & declutch gear retaining nuts	1-1/2 - 12	600
Pump cover bolts	5/16 - 18	25
Shift Shaft Piston Nut	3/8 - 24	30
Shift Fork Clamp Bolt	7/16 - 20	35

*Torques given apply to parts coated with machine oil. For dry parts increase torque 10%.