FORD

Service Manual

Tractors
TW5, TW15, TW25, TW35
8530, 8630, 8730, 8830

Part 1 – Engine Systems
Part 2 – Fuel Systems

Vol. 1

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Reprint

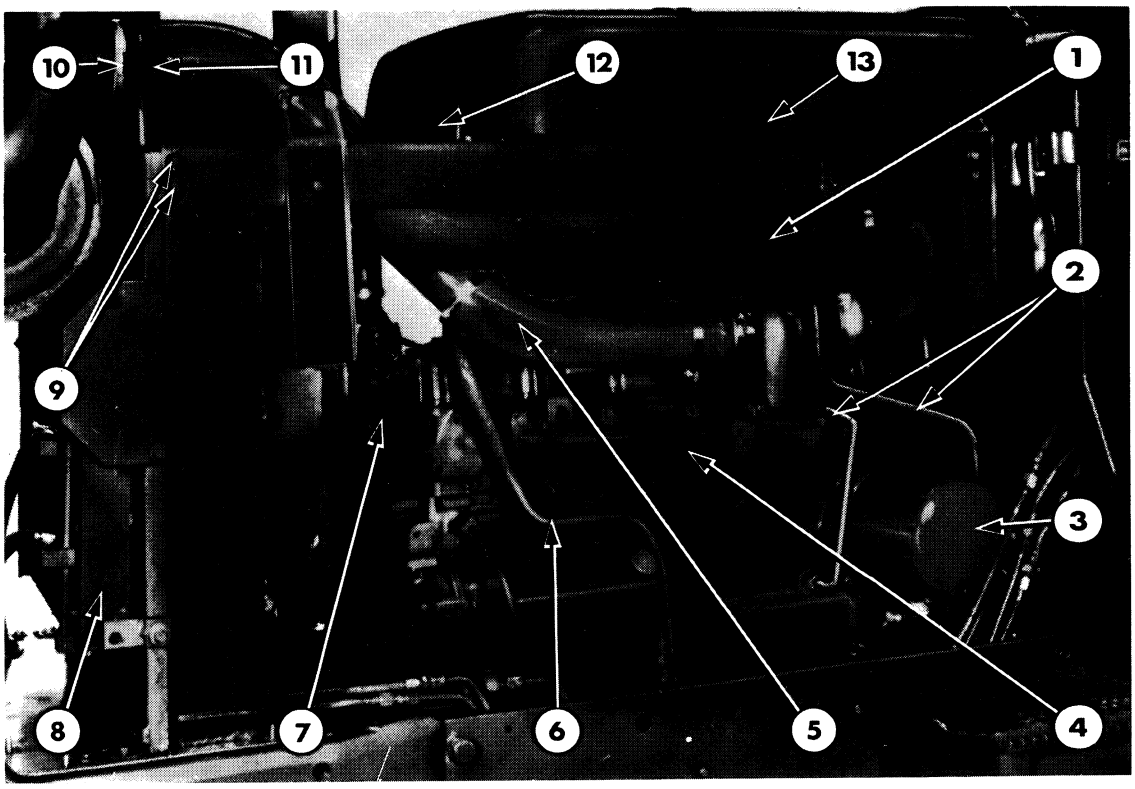


Figure 2
Access to Engine (TW-15)

1. Air Intake Tube
2. Turbocharger Lubrication Tubes
3. Engine Oil Filter
4. Exaust Manifold
5. Turbocharger to Muffler Tube
6. Breather Tube
7. Thermostat Housing
8. Hydraulic Oil Cooler
9. Fuel Tank Bracket Bolts
10. Air Cleaner Clamp
11. Flange Bolts
12. Muffler Support Bracket
13. Main Fuel Tank

6. Shut off the fuel at the main fuel tank.

7. Disconnect the wiring harness at the alternator and air intake sensor. Remove the harness from the fuel tank bracket.

8. Remove the eight bolts that attach the main fuel tank support brackets to the tractor.

9. Using a sling, remove the fuel tank and brackets from the tractor, Figure 4.

10. Remove the fan brace.

TW-25

With reference to Figures 5 and 6.

1. Remove the pre-cleaner and fuel tank cap.

2. Remove the muffler clamp and withdraw the muffler.

3. Remove the two side panels, grille and hood panel.

IMPORTANT: *Whenever a turbocharger is installed in a tractor, the following procedure should be followed:*

(i) Connect the oil supply tube to the turbocharger and tighten the connection securely.

(ii) Do not connect the oil return tube to the turbocharger at this time.

(iii) Connect the air inlet-to-turbocharger tubes and the turbocharger-to-exhaust tubes, as detailed previously. Tighten all locations securely.

(iv) Place a container under the oil return passage of the turbocharger bearing housing.

(v) Crank the engine with the diesel engine stop control pulled out. Oil under pressure from the engine lubrication system will flow out of the turbocharger bearing housing into the container. This procedure will provide initial lubrication to the turbocharger.

(vi) Connect the oil return tube to the turbocharger and tighten the connection securely.

16. Connect the upper radiator hose to the cylinder head.

17. Fill the radiator with coolant.

18. Refit the rocker cover, installing a new gasket, and tighten the bolts to the specified torque, see 'Specifications', Chapter 6. Connect the ventilating tube.

19. Lift the air cleaner and support assembly into place and attach with the hardware previously removed.

20. TW-5: Attach the muffler to the air cleaner support assembly and connect the air intake tube to the intake manifold.

    Ford TW-15 and TW-25: Connect the exhaust extension to the turbocharger exhaust outlet and attach it to the air cleaner support assembly. Connect the air intake tube to the inlet side of the turbocharger and the air cleaner.

21. Install the fuel tank assembly.

22. Turn on the fuel.

23. Position the wiring harness in the clips on the support brace and connect the harness at the alternator and air intake restrictor valve.

24. Install the top hood panel and the precleaner.

25. Install both hood side panels and the radiator grille panel(s).

26. Bleed the system as described in Part 2, "FUEL SYSTEM".

TW-35

27. Bolt the turbocharger and new gasket to the exhaust manifold. Install the oil lines between the turbocharger and the engine. Install the water pump if removed, using a new gasket.

28. Install the thermostat — fan hub housing. Attach the radiator hose and heater hose, Figure 9.

5. Remove the piston rings from the pistons with a piston ring expander or other suitable means, Figure 44.

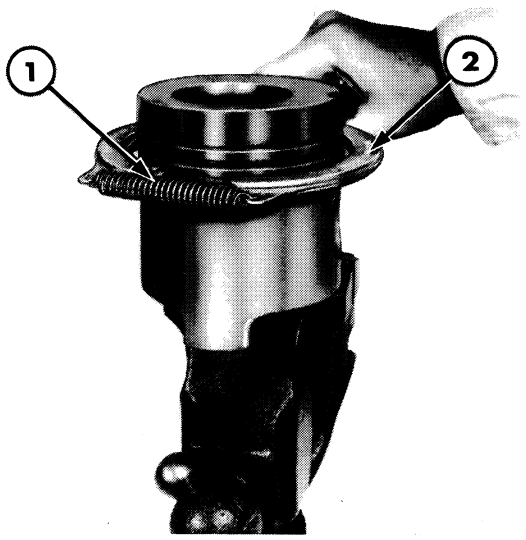


Figure 44
Removing Piston Ring
1. Piston Ring
2. Piston Ring Expander

DISASSEMBLY

1. Remove the piston pin snap ring (circlip) from each side of the piston and remove the pin.

2. Identify each piston to be sure it will be assembled to the rod from which it was removed.

CLEANING

1. Soak the pistons thoroughly in a stong cleaning solution.

2. Clean the piston ring grooves; a broken piston ring makes an ideal tool for this purpose.

INSPECTION

CONNECTING RODS

1. Inspect the connecting rods for signs of damage and the bearing bores for roundness and concentricity. Install a new connecting rod if the bore is damaged or not within tolerances, see 'Specifications', Chapter 6.

2. Check the connecting rod nuts and bolts. Replace any part that shows signs of wear or damage. Always use new connecting rod bearing cap nuts.

3. Check piston pin bushings for wear or damage. Measure outside diameter of piston pin and inside diameter of piston pin bushing. If bushing is damaged, or if the measurements indicate that a clearance between the bushing and the pin is not between 0.0005—0.0007 in (0.0127—0.0178 mm), the bushings must be replaced.

NOTE: *If a new piston pin bushing is installed, it must be reamed to provide the correct clearance.*

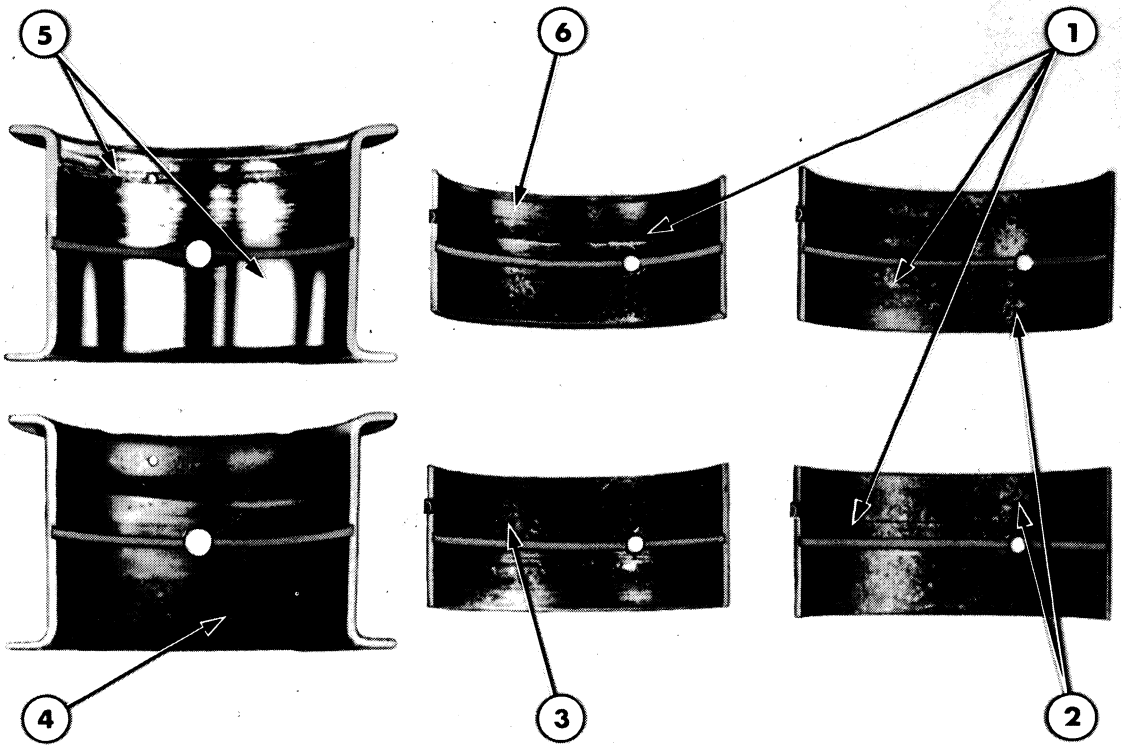


Figure 65
Typical Bearing Failures

1. Scratches
2. Embedded Dirt
3. Fatigue Failure
4. Craters or Pockets
5. Overlay Worn
6. Radii Ride

FLYWHEEL

The flywheel mounts on a flange at the rear of the crankshaft and is retained by six bolts. The mounting holes are unevenly spaced so that it can be mounted in only one position. The starter ring gear is mounted on the flywheel.

REMOVAL

1. Separating the tractor between the engine and the front transmission, see "SEPARATING THE TRACTOR" — Part 12.

2. Remove the pressure plate and clutch disc assembly from the flywheel, see "CLUTCHES" — Part 4.

3. Prior to removal, rotate the flywheel and use a dial indicator to measure the run-out, Figure 66, see 'Specifications', Chapter 6. If the flywheel is outside the specification check the mating surfaces of the flywheel and the crankshaft for correct seating.

4. Withdraw the flywheel attaching bolts and carefully remove the flywheel.

INSPECTION AND REPAIR

1. Inspect the flywheel ring gear and replace if the teeth are damaged. Check the flywheel for damage due to loosely or improperly fitted ring gear.

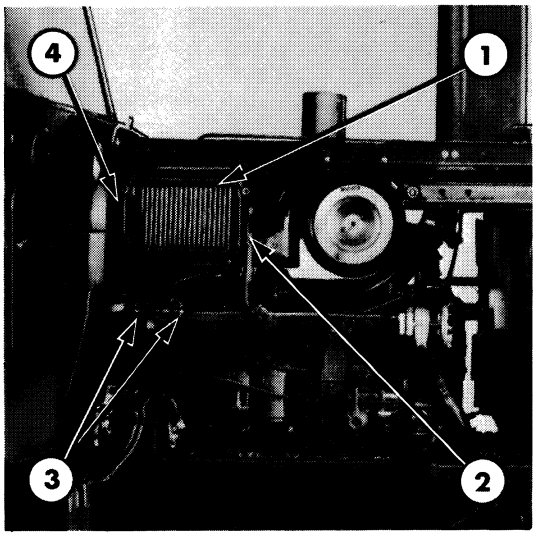


Figure 7
Turbocharger (TW-35)
1. Intercooler Radiator
2. Front Mounting Bracket
3. Base Mounting Bolts
4. Rear Mounting Bracket

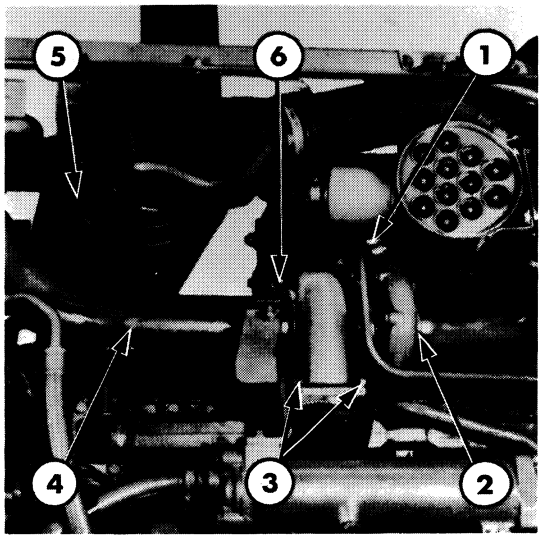


Figure 8
Turbocharger (TW-35)
1. Turbocharger-to-Intake Manifold Tube Clamp
2. Intake Boot Clamp
3. Turbocharger Mounting Nuts
4. Exhaust Pipe
5. Air Cleaner
6. Exhaust Pipe Clamp

3. Withdraw the four bolts on each side of the hood panel. Take care not to distort or overflex the hood panel on removal.

4. To remove the intercooler assembly remove the front and rear mounting bracket bolts, the hose clamps, the intercooler-to-tip turbine fan "V" band clamp and the base mounting bolts, Figure 7. Remove the unit from the tractor.

5. To remove the turbocharger remove the exhaust pipe clamp, the turbocharger-to-intake manifold tube clamp, the air intake boot clamp, and the turbocharger mounting nuts, Figure 8.

6. Disconnect the oil supply and return tubes from the turbocharger. Swing the tubes clear to allow access to the turbocharger.

7. Remove the turbocharger securing nuts and withdraw the turbocharger.

DISASSEMBLY

With reference to Figure 9.

1. Clean the exterior of the turbocharger with cleaning solvent to remove accumulated surface matter before disassembly.

2. Match-mark the compressor housing, turbine housing and centre housing, with a punch or scribe to facilitate orientation of the housings during reassembly.

3. Bend down the tabs of the lockplates and remove the bolts, lockplates, clamps and housing.

NOTE: *Exercise care when removing the compressor housing to avoid damaging the compressor wheel blades.*

PART 1
ENGINE SYSTEMS

Chapter 3
INTERCOOLER

A. DESCRIPTION AND OPERATION

The intercooler on the Ford TW-35 Tractor cools the air from the turbocharger before it enters the intake manifold. Cooling the air increases its density and provides a greater air mass. This permits increased fuel delivery to the engine and a corresponding increase in engine horsepower.

The system functions as follows. Refer to Figure 1.

Intake air from the air cleaner is compressed by the turbocharger and forced under pressure towards the intake manifold. Approximately 10% of this high pressure air is channelled off to drive a tip turbine fan before escaping to atmosphere. The remaining 90% of the intake air is directed through the intercooler matrix where it is cooled by a continuous flow of cool filtered air from the tip turbine fan. The pressurised intake air has a greater density as a result of the cooling and a higher volume of fuel can be burnt in the correct air/fuel ratio to give increased power.

Air entering the pre-cleaner is directed through tubes which spin the air. This spinning or centrifugal action removes contaminents from the air. The vacuum created by the engine exhaust removes the contaminents from the pre-cleaner and discharges them through the tractor exhaust system.

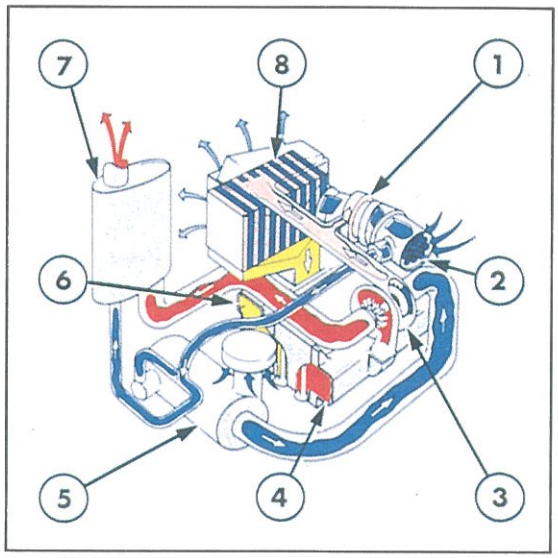


Figure 1
Turbocharger Intercooler

1. Tip Turbine Fan
2. Intercooler Air Intake with Exhaust Aspirated Air Cleaner
3. Turbocharger
4. Engine Exhaust Manifold
5. Engine Air Cleaner with Exhaust Aspirator
6. Engine Intake Manifold
7. Engine Exhaust Silencer
8. Intercooler Matrix

Remove the hoses from the oil cooler and flush the cooler on the TW-35. Replace gaskets and O-ring.

DRAINING AND FILLING THE COOLING SYSTEM

To drain the cooling system, open the drain cock on the right-hand side of the engine block, and the radiator outlet on the lower right-hand side of the radiator. Open the radiator pressure cap to speed draining.

To fill the system, close the drain cocks, fill the system with coolant and add rust inhibitor or antifreeze, according to the season and locality.

All permanent antifreeze sold by reputable manufacturers contains an anti-rust additive. Therefore, the addition of rust inhibitor when permanent antifreeze is used will not generally by necessary.

B. RADIATOR AND THERMOSTAT

RADIATOR

REMOVAL

1. Remove the side panels, pre-cleaner, top hood panel, grille and grille panels.
2. Drain the coolant from the radiator.
3. Disconnect the radiator hoses from the radiator.
4. Disconnect the hydraulic oil cooler tubes.
5. Fully discharge the air conditioning system, where fitted, see Part 13 — 'Accessories and General'. Disconnect the lines to the condenser.
6. Remove the bolts that retain the radiator, oil cooler and condenser, (where fitted), support the assembly.
7. Remove the radiator, oil cooler, condenser, (where fitted), and fan shroud from the support assembly.

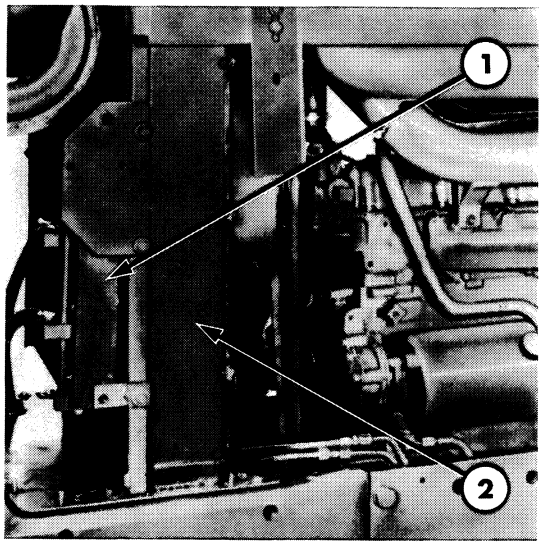


Figure 3
Radiator Removal — TW-5 and TW-15
1. Radiator Support
2. Oil Cooler/Condenser

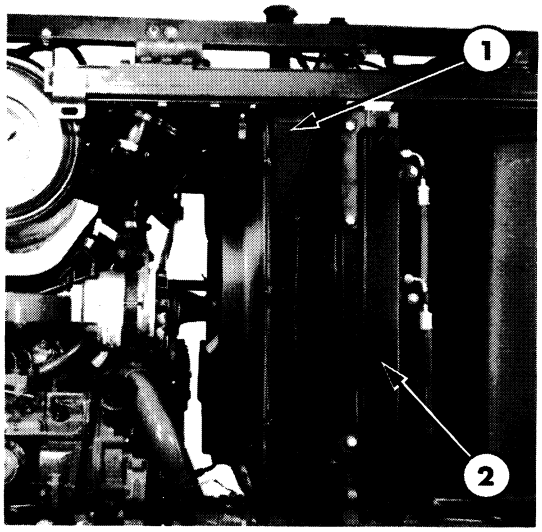


Figure 4
Radiator Removal — TW-25 and TW-35
1. Radiator Support
2. Oil Cooler/Condenser

CRANKSHAFT (Cont.)

Main Journal Wear Limits	0.005 in (0.13 mm) Maximum
Main and Crank Pin Fillet Radius	0.12—0.14 in (3.05—3.56 mm)
Thrust Bearing Journal Length	1.459—1.461 in (37.06—37.11 mm)
Intermediate Bearing Journal Length	1.455—1.465 in (36.96—37.21 mm)
Rear Bearing Journal Length	1.485—1.515 in (37.72—38.48 mm)
Rod Bearing Journal Length	1.678—1.682 in (42.62—42.72 mm)
Rod Bearing Journal Diameter	2.7496—2.7500 in (69.839—69.860 mm) (Blue Liners) 2.7500—2.7504 in (69.86—69.87 mm) (Red Liners)
End Play	0.004—0.008 in (0.102—0.203 mm)
Rod Bearing Out-of-Round	0.0002 in (0.005 mm) Total Indicator Reading
Taper-Surface Parallel to Centre Line of Main Journal	0.0002 in (0.005 mm)
Crankshaft Rear Oil Seal Journal Diameter	4.814—4.808 in (122.28—122.12 mm)
Crankshaft Pulley Journal Diameter	1.751—1.750 in (44.48—44.45 mm)
Crankshaft Timing Gear Journal Diameter	1.821—1.820 in (46.25—46.23 mm)

MAIN BEARING

Liner Length (Except Thrust Liner)	1.10—1.11 in (27.94—28.19 mm)
Liner Length (Thrust Liner)	1.453—1.455 in (36.91—36.96 mm)

LINER IDENTIFICATION

Identifying Mark	Colour Code	Material	Wall Thickness	Specified Clearance
PV or G	Red	Copper Lead	0.1245—0.1250 in (3.162—3.175 mm)	0.0022—0.0045 in (0.056—0.114 mm)
PV or G	Blue	Copper Lead	0.1249—0.1254 in (3.172—3.185 mm)	0.0022—0.0045 in (0.056—0.144 mm)
G and AL	Red	Aluminium Tin Alloy	0.1245—0.1250 in (3.162—3.175 mm)	0.0022—0.0045 in (0.056—0.114 mm)
G and AL	Blue	Aluminium Alloy	0.1249—0.1254 in (3.172—3.185 mm)	0.0022—0.0045 in (0.056—0.114 mm)

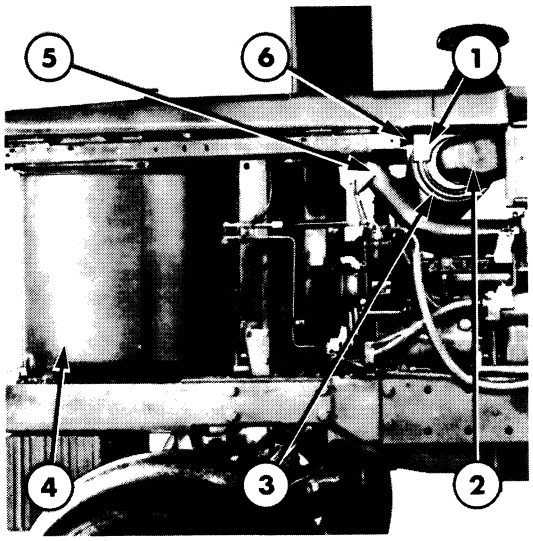


Figure 6
Air Cleaner

1. Air Cleaner bracket
2. Clean Air Intake Tube
3. Air Cleaner
4. Main Fuel Tank
5. Exhaust Pipe
6. Aspirator Tube

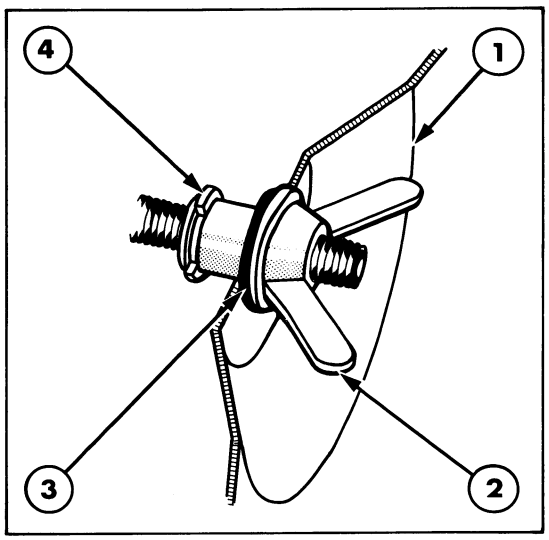


Figure 7
Air Cleaner Outer Element

1. Outer Element
2. Wing Nut
3. Flat Washer
4. "C" Clip

INSTALLATION

1. Installation of the air cleaner is the removal procedure in reverse.

On Ford TW-25 and TW-35 vehicles ensure that the rubber faced side of the flat washer is placed against the outer surface of the element and the "C" clip wing nut and flat washer are installed as shown in Figure 7.

C. FUEL TANK, FILTERS AND LINES — OVERHAUL

MAIN FUEL TANK

REMOVAL

1. Disconnect the battery.
2. Remove the pre-cleaner, side panels, top hood panel, radiator grille and panels.
3. Remove the muffler assembly.
4. Remove the air cleaner tube.
5. Shut off the fuel at the fuel shut-off valve.
6. Disconnect the fuel line and sender gauge wires.
7. Disconnect the wiring harness at the alternator and air intake sensor. Remove the harness from the fuel tank bracket.
8. Remove the bolts that attach the main fuel tank support brackets to the tractor.

PART 2
FUEL SYSTEM

Chapter 3
FUEL INJECTION PUMP — IN-LINE TYPE

A. DESCRIPTION AND OPERATION

The pump is mounted at the front right-hand side of the engine being driven by a gear timed to the camshaft drive gear, see "ENGINE SYSTEMS" — Part 1.

An exploded view of the in-line type fuel injection pump is shown in Figure 1.

The fuel injection pump is of the constant stroke, in-line type, driven at half engine speed by the timing gears. There is one pumping element per cylinder actuated through tappet rollers by a fully enclosed camshaft.

PUMP ELEMENTS

The pumping elements accurately meter and deliver the fuel to the injectors.

Each of the pumping elements consists of a barrel and plunger lapped together to give an accurate fit, Figure 2. Two diametrically opposed drillings in the barrel form fuel inlets and the barrel is splined, with a master spline, for correct location within the pump body.

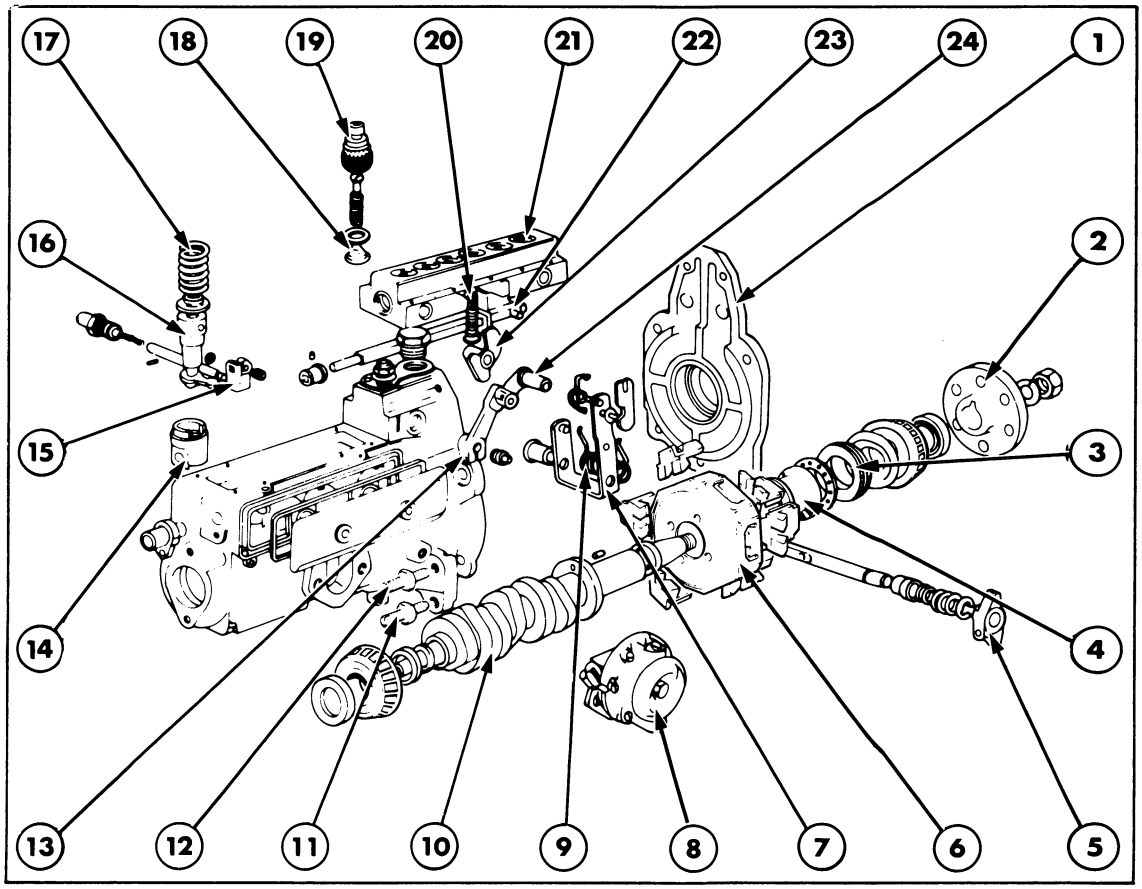


Figure 15

In-Line Fuel Injection Pump — Exploded View

1. Governor End Cover
2. Pump Drive Gear Adaptor
3. Thrust Pad
4. Governor Weight Assembly
5. Stop Quadrant
6. Carrier
7. Rocking Lever
8. Fuel Lift Pump
9. Governor Main Control Spring
10. Camshaft
11. Idle Speed Adjusting Screw
12. Maximum Speed Adjusting Screw
13. Stop Control Lever
14. Tappet Assembly
15. Control Fork
16. Pumping Element
17. Return Spring
18. Delivery Value
19. Volume Reducer
20. Maximum Fuel Stop Screw
21. Pump Body
22. Control Rod
23. Maximum Fuel Stop Lever
24. Stop Control Shaft

4. Remove the plungers, springs and spring seats from their respective barrels and keep each set together. Remove the delivery valve retainers, delivery valves, springs and volume reducers. Keep each set together and place them with the corresponding plungers, springs and spring seats.

5. Carefully tap the base of the pump barrels with a hide or copper mallet to free the splines. Withdraw the barrels, delivery valve guides and sealing washers.

   Keep these components in sets with the parts already removed.

2. Set the variable speed calibrating machine to 900 rev/min. Turn on the fuel supply and allow fuel to flow from the pump body bleed screw nearest to the governor. Tighten the bleed screw when the fuel flows free of air bubbles. Run the machine at 900 rev/min for 10 minutes to allow the injection pump and oil to warm up.

3. Hold the control lever in the full delivery position and check the delivery from No. 6 element over an average of four deliveries, each of 200 injections. Adjust the maximum fuel stop screw on the pump housing to give the specified average delivery and tighten the locknut.

4. Check the other elements of the pump in the same manner and adjust the delivery of each element to within 0.2 cc of the first element checked.

NOTE: *When calibrating, ignore the first set of readings after adjustments have been made.*

5. When calibration is satisfactory, repeat the test with the calibration machine set at 100 rev/min.

   If the reduction in delivery at 100 rev/min exceeds 40% of that at 900 rev/min, a worn element is indicated. However, before installing a new element, visually check the delivery valve and guide. If either shows signs of wear, install a new delivery valve and guide and re-test the pump.

6. Run the pump at 100 rev/min then operate the stop control and ensure all elements cease delivery just before the control rod reaches the end of its travel.

E. BOOST CONTROL

The turbocharged engines give a higher power output and provide fuel economy through increased efficiency.

However, it is inherent in the design of the turbocharger that the volume of air fed to the engine cylinders falls off as the speed of the turbocharger drops. Since the turbocharger is driven by the engine exhaust gases — at low speed and low throttle openings, the turbocharger speed will also be low and the volume of air or boost provided will be reduced. Under these conditions, the normal maximum fuel setting must be restricted to prevent the emission of smoke. This is the function of the boost control unit.

Governmental smoke regulations in certain locations necessitate the installation of a boost control unit to provide automatic control of maximum fuel delivery under low turbocharger speed conditions.

The boost control unit is mounted on top of the in-line type fuel injection pump, above the governor housing and senses the inlet manifold air pressure generated by the turbocharger. When the manifold air pressure drops below a pre-determined level the control unit automatically restricts the amount of fuel fed to the engine.

TEST PLAN—FORD TW-35—401 in³ (6571 cm³) Turbocharged/Intercooled Engine

IN-LINE TYPE FUEL INJECTION PUMP WITH BOOST CONTROL—TYPE NUMBER P5641

All tests should be performed using Hartridge 875 or 1100 test machines.
The test fuel oil should be at 40°C ±2°C (104°F ±4°F).

Type	Enclosed camshaft with mechanical governor
Plunger Stroke and Diameter	9 mm x 9 mm
Camshaft Rotation	Clockwise from drive end
Lubrication	Oil fed direct from engine pressurized supply
Oil Capacity	0.83 Imp Pint (1 U.S. Pint) (0.47 Litres)
Oil Grade	Same as Engine
Pump Timing	25° B.T.D.C.
Camshaft End Float	0.0008—0.005 in (0.02—0.13 mm)
Camshaft End Float Shims	0.004—0.008 in (0.102—0.203 mm)
Dimensions, rear control fork to end of square section on control rod	0.02 in (0.5 mm)
Dimensions, B.D.C. to point of spill cut-off	0.114—0.122 in (2.90—3.10 mm)
Phasing Spacers:	
Number 1	0.151—0.153 in (3.85—3.90 mm)
Number 2	0.155—0.157 in (3.95—4.00 mm)
Number 3	0.159—0.161 in (4.03—4.10 mm)
Number 4	0.163—0.165 in (4.15—4.20 mm)
Number 5	0.167—0.169 in (4.25—4.30 mm)
Phasing Tolerance	±½°
Plunger End Float	0.002—0.008 in (0.05—0.20 mm)
Lower Spring Seat	Seats graded in thickness from 0.023—0.085 in (0.60—2.10 mm) in steps of 0.004 in (0.1 mm)

Governor

Type	Mechanical
Pump No Delivery Speed	1250 rev/min (Pump)
Idling	3.0 ±0.8 cc in 200 strokes at 300 rev/min
Governor Spring Identification	Blue Green

Tightening Torques

	lbf ft	*Nm*	*Mkg*
Screws, Governor Backplate to Pump	5	7	0.7
Delivery Valve Holders	40	54	5.5
Pump Drive Gear Adaptor Retaining Nut	55	75	7.6
Governor Spring Retaining Bolt	3	4	0.4
Control Fork Socket Screws	2	3	0.3
Pump Body, Socket Screws	5	7	0.7
Fuel Injection Pump to Front Plate	28	38	3.9
Bolt Gear to Injection Pump	23	31	3.2

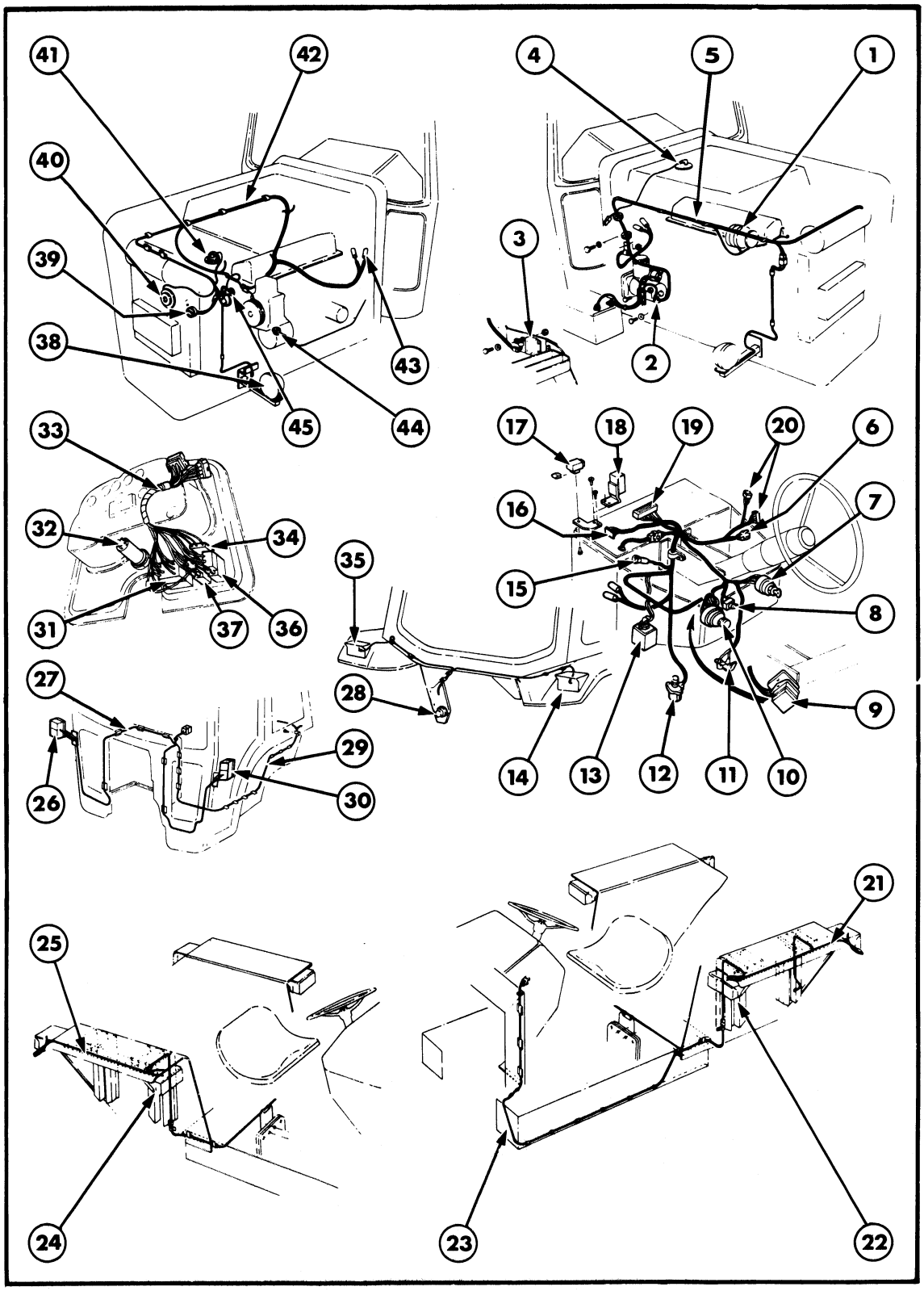


Figure 1
Electrical System — Tractors with "A" Prefixed Serial Numbers

WINDSHIELD WASHER MOTOR ASSEMBLY

REMOVAL

1. Release the reservoir retaining clips. Lift the reservoir lid and disconnect the feed tube.

2. Disconnect the feed wires from the motor then remove and empty the reservoir.

DISASSEMBLY

1. Using a small bladed screwdriver, carefully pry out the motor retaining ring, Figure 11.

2. Using pliers, grip the wall around the plug terminal and gently pull the motor assembly.

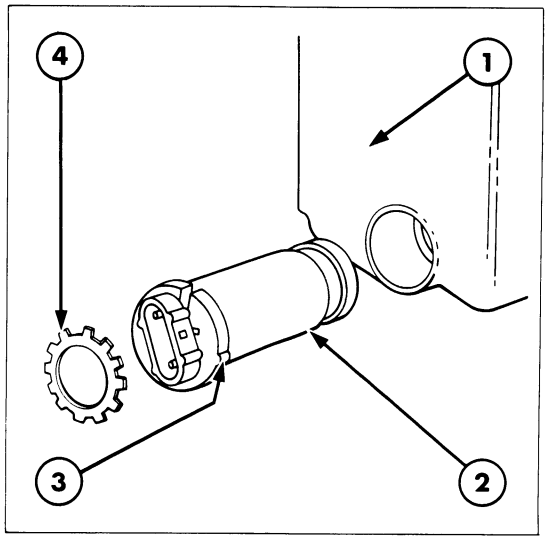


Figure 11
Windshield Washer Motor Installation
1. Reservoir
2. Motor Assembly
3. Projection
4. Retaining Ring

INSPECTION AND REPAIR

1. Clean the reservoir and filter (where fitted). Inspect the seal and impeller and replace if worn or damaged. Renew a faulty motor.

RE-ASSEMBLY

1. Lightly lubricate the outside diameter of the motor seal with a dry lubricant such as powdered graphite. This will prevent the seal from sticking in the bore and make assembly easier.

2. Align the small projection, Figure 11, on the motor end cap with the slot in the bore and insert the motor so that the seal seats against the bottom of the bore.

3. Using a 12 point 1.0 in (25.4 mm) socket, hand press the retaining ring securely against the motor end cap.

INSTALLATION

1. Installation of the windshield washer motor assembly is the removal procedure in reverse.

2. Fill the reservoir with windshield washer solution and operate the washer system. Check for leaks.

IMPORTANT: *To avoid pump damage, do not operate the washer pump when the reservoir is empty.*

HEATER BLOWER MOTOR

For heater blower motor overhaul see Part 13, 'Accessories and General' — Chapter 2 — Section B.

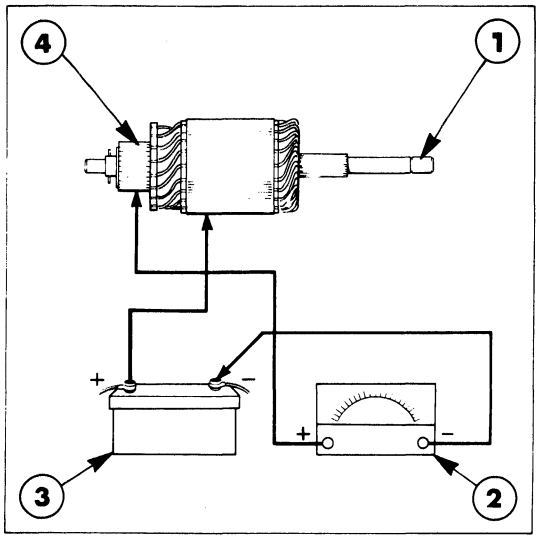


Figure 4
Testing Armature for Grounded Circuits
1. Armature Assembly
2. Voltmeter
3. Battery
4. Commutator

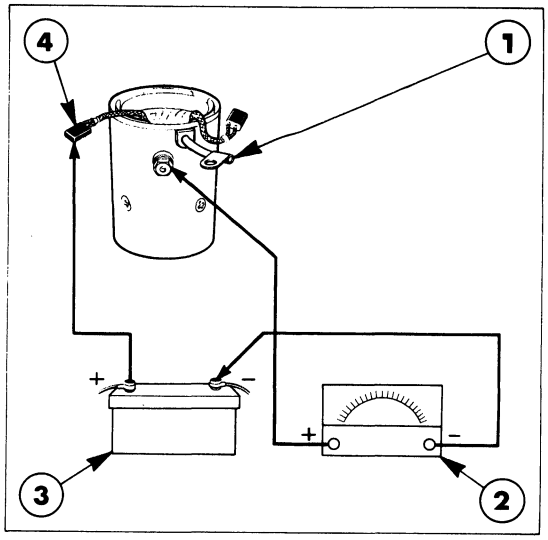


Figure 5
Testing Field Coils for Open Circuit
1. Eyelet Wire
2. Voltmeter
3. Battery
4. Insulated Brush

Testing Armature for Grounded Circuits

With reference to Figure 4.

1. Attach the voltmeter negative lead to the battery negative teminal.

2. Attach one end of a jumper lead to the battery positive terminal.

3. Touch the armature core with the jumper lead whilst touching a commutator segment with the voltmeter positive lead. Test each segment of the commutator in this manner. Observe the voltmeter and, if a voltage reading occurs, the armature windings are grounded and a new armature must be installed.

Testing Field Coils for Open Circuits

With reference to figure 5.

1. Connect the voltmeter positive lead to the starting motor field terminal.

2. Connect the voltmeter negative lead to the battery negative terminal.

3. Attach a jumper lead between the battery positive terminal and to one of the insulated brushes. The voltmeter should indicate battery voltage.

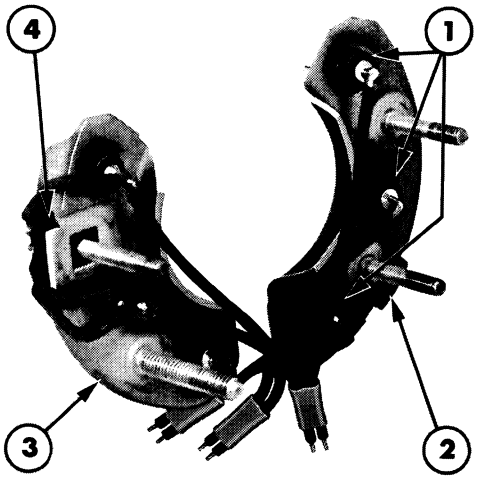


Figure 8
Rectified Assembly

1. Diodes
2. Negative Plate
3. Positive Plate
4. Field Diode Assembly

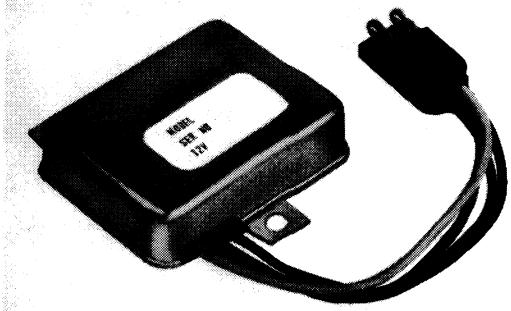


Figure 9
Alternator Regulator Assembly

The plates are heat-sinks which both dissipate heat and serve as conductors for the diodes. Two studs on each plate attach the assemblies to the rear housing. One stud on the positive plate is the alternator regulator terminal and the other is the output terminal.

The positive plate is insulated from the rear housing but the negative plate is attached and the upper stud serves as the alternator ground connection.

As the rotor revolves, the diodes rectify or convert the alternating current of the stator to a direct current which may be used to effectively charge the battery.

The three field diodes are encased in an epoxy resin and mounted on the positive diode plate. One end of each of the three stator output wires also connects to one of these diodes. The field diodes supply direct current to the rotor field winding and can only be replaced as a complete unit.

REGULATOR

The regulator controls and maintains the alternator output voltage at a safe working level. The unit consists of diodes, transistors and calibrating resistors and four wires connect the regulator into the charging system, Figure 9.

The regulator components are sealed in epoxy resin and can only be replaced as a complete unit.

The regulated voltage level is established in manufacture and cannot be adjusted in service.

There is no cut-out system or current regulating system in the regulator. The high capacity positive diode assembly functions as the charging system cut-out. The alternator is so designed that it is self-current limiting. When the maximum current output is reached, it cannot be increased with a further increase in rotor speed.

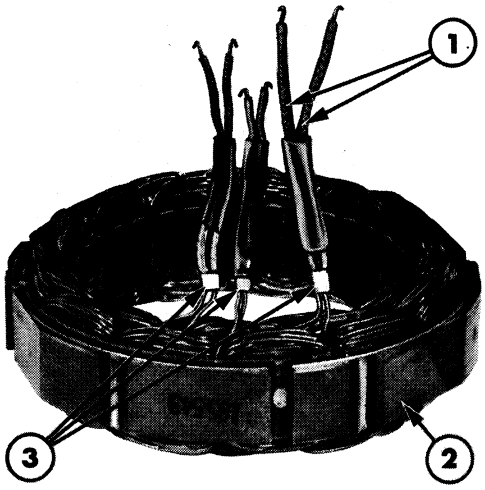


Figure 35
Stator Connecting Lead Junctions
1. Diode Connecting Leads
2. Stator
3. Stator Junctions

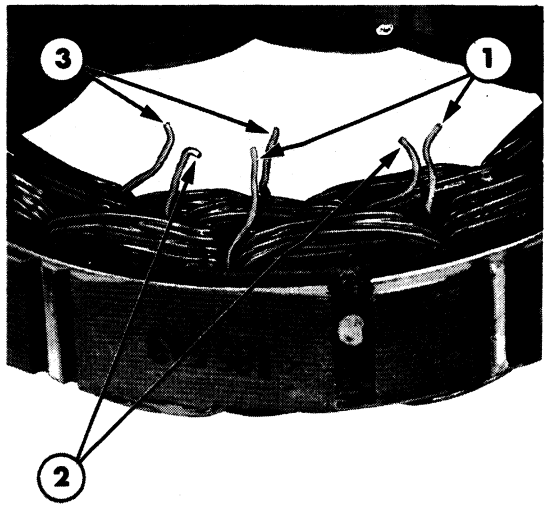


Figure 36
Stator Connecting Leads Separated for Test Purposes
1. Circuit A
2. Circuit B
3. Circuit C

Fan, Pulley and Spacer

1. Inspect the fan for cracked or broken fins and note the condition of the mounting hole. If the hole is worn from running loose, install a new fan.

2. Inspect the pulley for possible wear on the drive surfaces and check the condition of the bore and keyway.

3. Examine the spacer for cracks. Install a new spacer if cracks are evident.

Rotor and Front Housing

1. Inspect the front bearing cavity for evidence of wear. Note the condition of the retainer recess and replace the housing if necessary. If the original housing is to be re-used, clean with solvent then dry with compressed air.

2. Examine both the rotor and stator poles for signs of rubbing indicating worn bearings.

3. If there is no visible evidence of worn bearings, check whether the bearings allow side movement of the rotor shaft, if so the bearings must be renewed.

NOTE: *When fully reconditioning an alternator the bearings should be renewed irrespective of apparent condition. The bearings are fully sealed and cannot be serviced.*

B. SPECIFICATIONS

LIGHTING AND INSTRUMENTATION

'A' PREFIX	Voltage	Candle Power	Wattage
Headlamps			
Sealed Beam	12	—	40/40
Non-Sealed Beam	12	—	45/40
Side Lamps			
Rear Lamp	12	—	5
Stop and Rear lamp	12	—	21/5
Front Lamp	12	—	5
Flasher Lamps	12	—	21
Licence Plate Lamps	12	—	5
Plough Lamp	12	—	55
Plough Lamp Warning Light	24	—	2
'C' PREFIX			
Headlamps			
Sealed Beam	12	—	40/40
Utility Lamps	12	—	35
Side Lamps			
Rear Lamp	12	4	—
Flasher Lamps	12	32	—

INSTRUMENT PANEL LAMPS

'A' PREFIX			
Warning Lamps	12	—	2.2
'C' PREFIX			
Warning Lamps	12	2	—
'A', OR 'C' PREFIX			
High Beam Warning Lamp	12	1	—

WIRING DIAGRAM

'A' Prefix

FORD TW-5, TW-15, TW-25 and TW-35
— WITH CAB

WIRING DIAGRAM
FORD TW-25 – TW-35
WITH CAB/WITH ELECTRONIC INSTRUMENT PANEL

MAIN REAR HARNESS

C) Auxiliary Fuel Tank Sender (cont'd)

A resistance in excess of 900 Ohms will cause the electronic instrument panel to display an open circuit fault (OPEN). The short circuit fault (SH:CR) is displayed if the resistance is below 14 Ohms.

D) Handbrake Warning Switch.

A magnetic type reed switch located beneath the tractor handbrake assembly senses the position of the handbrake handle. With the handle in the fully lowered (parking brake off) position, a steel tab locates within the switch, and masks the magnet from the switching element so that the switch remains open. As the handbrake lever is raised, to apply the brake, the masking tab is withdrawn from the switch. The magnetic influence on the switching element causes the switch to close, actuating the warning light, and audible alarm if the vehicle speed is in excess of 0.5 mph, (0.8 Km/h).

E) Alternator Regulator.

The Regulator is situated on the inside surface of the right-hand cab/platform step plate frame, and is coupled to the Extension Wiring Harness by a water-resistant 4-pin connector. Battery charge condition is sensed at the regulator by the electronic instrument panel, which displays charge voltage segments according to the following table:

Battery Voltage	Segments
less than 10.5V	1
10.5V – 11.5V	2
11.5V – 12.5V	3
12.5V – 13.5V	4
13.5V – 14.5V	5
14.5V – 15.5V	6
15.5V – 16.5V	7
over 16.5V	8

The audible alarm is sounded after a two second delay, when battery voltage falls below 10.5V or rises above 16.5V. The charge warning light will illuminate if the alternator is not charging the battery.

F) Engine Coolant Temperature Sender.

The engine coolant temperature sender is located in the side of the thermostat housing and is accessible from the left-hand side of the engine. The sender is coupled to the main front harness by a single stud type connector. The resistance of the sender changes proportionally with engine coolant temperature and the electronic instrument panel displays coolant temperature segments according to the following table:

Temperature		Sender Resistance	Segments
(°C)	(°F)	(Ohms)	
Up to 55	Up to 131	over 880	1
55 – 66	131 – 151	581 – 880	2
66 – 77	151 – 171	401 – 581	3
77 – 88	171 – 191	281 – 401	4
88 – 99	191 – 211	191 – 281	5
99 – 110	211 – 231	141 – 191	6
110 – 121	231 – 251	101 – 141	7
over 121	over 251	less than 101	8*

*When eight coolant temperature segments are illuminated the message "STOP" will display accompanied by an audible alarm if the engine is running.

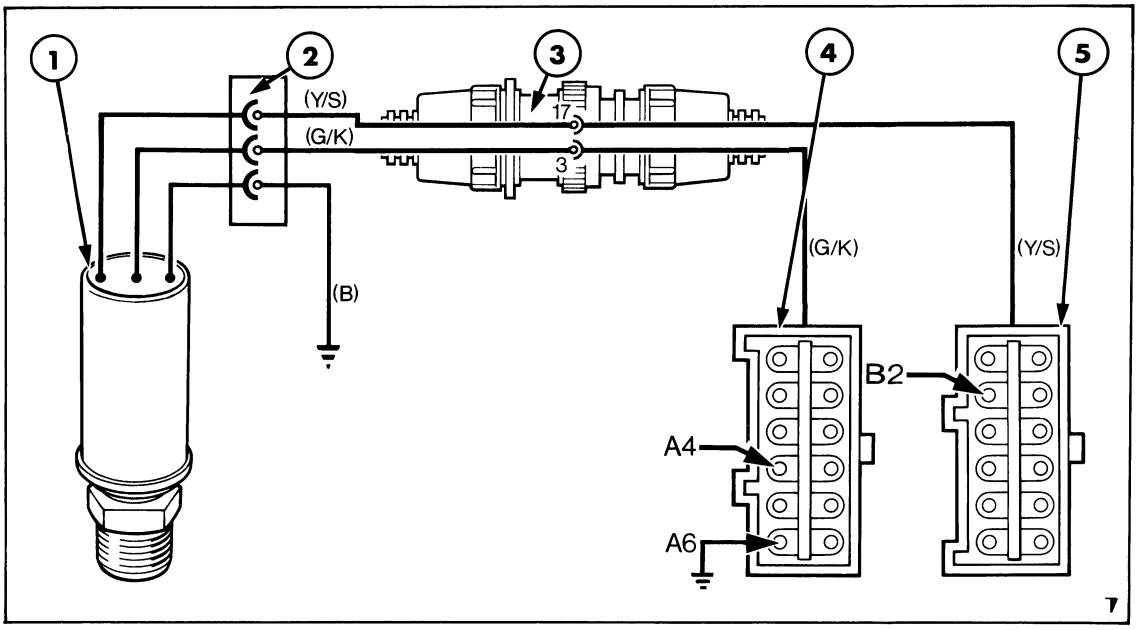


Figure 12
Engine Oil Pressure Sender Circuit

1. Engine Oil Pressure Sender
2. Sender Connector
3. Bulkhead Connector 1
4. Harness-to-Panel Connector 'A'
5. Harness-to-Panel Connector 'B'

CONDITION 3: Engine Oil Pressure Sender Circuit OPEN

Instrument panel displays OPEN fault in engine oil pressure circuit (engine oil pressure bargraph flashing) with engine off and key-start switch on.
With reference to Figure 12.

NOTE: *The sender operates on a +5.0V internal power supply from the instrument panel. Do not attempt to power from a +12.0V source.*

TEST	RESULT	ACTION
1. Inspect the connector on the engine oil pressure sender.	YES	Go to 2
• Are the terminals clean and does the connector fit securely together?	NO	Rectify poor connection and recheck function

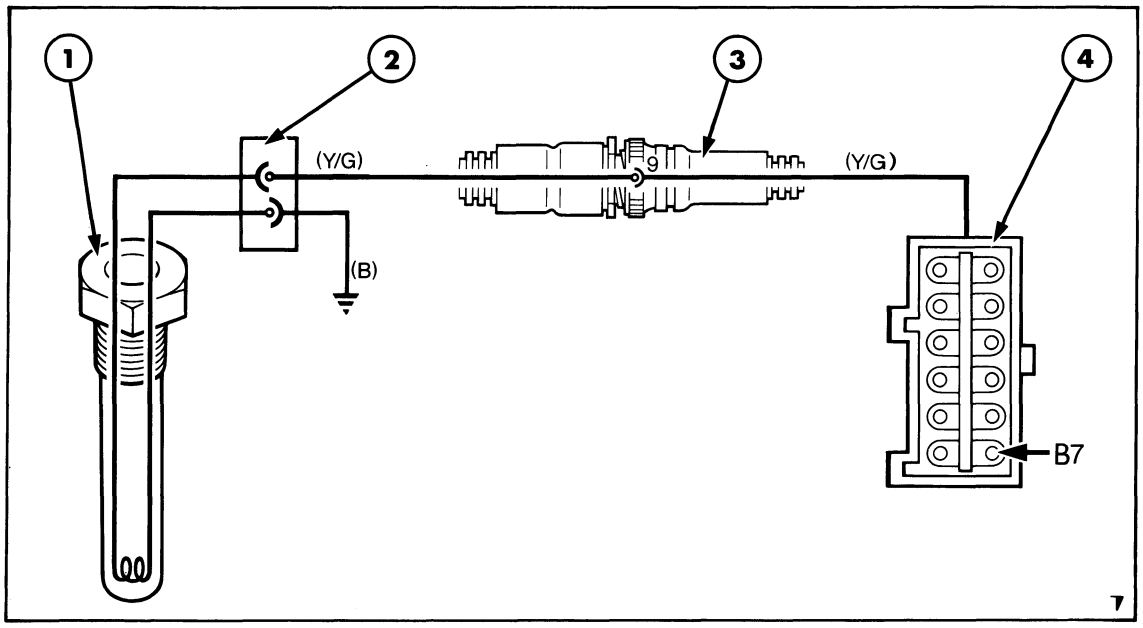


Figure 16
Tractor Ground Speed Sender Circuit

1. Tractor Ground Speed Sender
2. Sender Connector
3. Bulkhead Connector 3
4. Harness-to-Panel Connector 'B'

CONDITION 11: Tractor Ground Speed Sender Circuit OPEN

Instrument panel displays OPEN fault in tractor ground speed circuit. (MPH legend flashing). With reference to Figure 16.

TEST	RESULT	ACTION
1. Identify the tractor ground speed sender connector.	YES	Go to 2
• Are the terminals clean and does the connector fit firmly together?	NO	Rectify poor connection and recheck function.

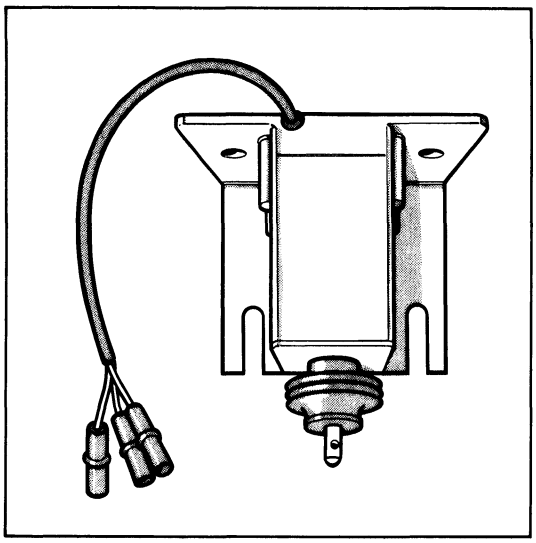


Figure 4
Implement Status Switch

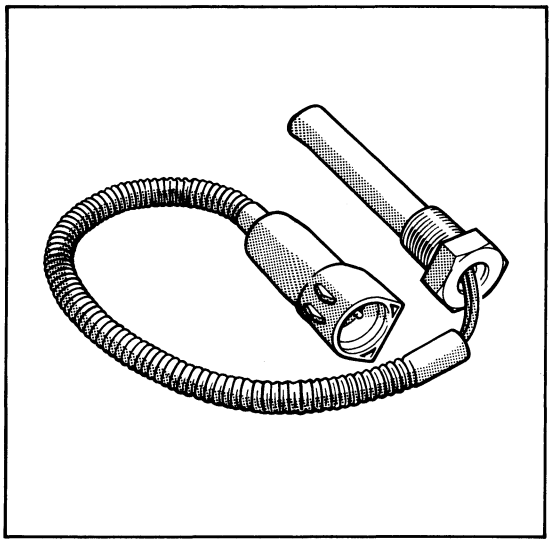


Figure 5
Wheel Speed Sensor

- water/oil does not drip on the face of the unit or in front of it.

- the location is protected from stubble and possible debris.

- the sensor is facing rearward to aid in protecting the face from physical abuse.

- the position is as vibration free as possible. Excessive vibration may cause inaccurate speed readings.

- the sensor cable connected to the tractor electrical harness is routed to avoid chafing, and is securely clipped.

3. Implement Status Switch

The implement status switch, Figure 4, is installed at a location on the 3-point hitch or on the towed implement where it can indicate to the control console whether the implement is in or out of work, (implement up or down).

4. Wheel Speed Sensor (already installed on tractor)

The control console requires an input which is related to wheel speed and this is achieved by using a sensor.

The wheel speed sensor, Figure 5, is located on the left-hand side of the transmission housing and senses rotational speed from the splines of the transmission output gear coupling.

This rotational speed, when the tractor is travelling, is fed to the control console where it is used to compute percentage wheel slip.

D. PERFORMANCE MONITOR – FAULT FINDING

SYMPTOM	POSSIBLE CAUSES	REMEDY
1. Display blank	Loss of +12 VDC power.	Check wiring harness and connectors between Instrument Panel and Performance Monitor. Check ignition switch + 12 V connection.
	Console defective.	Install a new console and recheck function.
2. "Err" displayed	Recent loss of + 12 VDC power	Re-programme the Time of Day Function.
	Selected function is detected to contain an invalid number.	Re-programme the indicated function.
	Console defective.	Install a new console and recheck function.
3. No AREA accumulation or AREA/HR prediction or wheel slip indication	Incorrect installation of implement status switch.	Turn tractor key-start switch to ON, Performance Monitor should power-up. Press RESET (AREA) switch, with AREA displayed, if UP message was displayed, it should clear. UP message should alternate on and off each time the switch is pressed. If so, check installation of implemement status switch. Ensure trip spring to implement status switch is correctly stretched.
	Implement status switch input inhibited due to broken or damaged cable or because implement status switch is defective.	Visually inspect implement status switch cable for damage. If damage is found, repair as described in Temporary Cable Repair
	No axle speed input.	Use the Electronic Instument Cluster to check out the operation ofAxle speed sensor. If operating correctly, check the wiring harness between the Instrument Panel and Performance Monitor. Check the connectors and make certain the pins are not pushed back.
	No radar speed input.	Use the Distance measuring feature of the Performance Monitor to determine if the Radar is functioning.
	Console defective.	Install a new console and recheck function.

INSTALLATION

1. Installation of the windshield wiper motor assembly is the removal procedure in reverse.

   - On installation ensure all mounting bolts and nuts are tightened to the correct torques, see 'Specifications' – Chapter 5. Check the wiper and motor assembly for effective action and renew the wiper blade if worn or damaged.

HEATER BLOWER MOTOR

For heater blower motor overhaul see Part 13, 'Accessories and General' – Chapter 6 – Section B.

C. WIRING AND ELECTRICAL SYSTEM CHANGES – TRACTOR WIRING DIAGRAMS

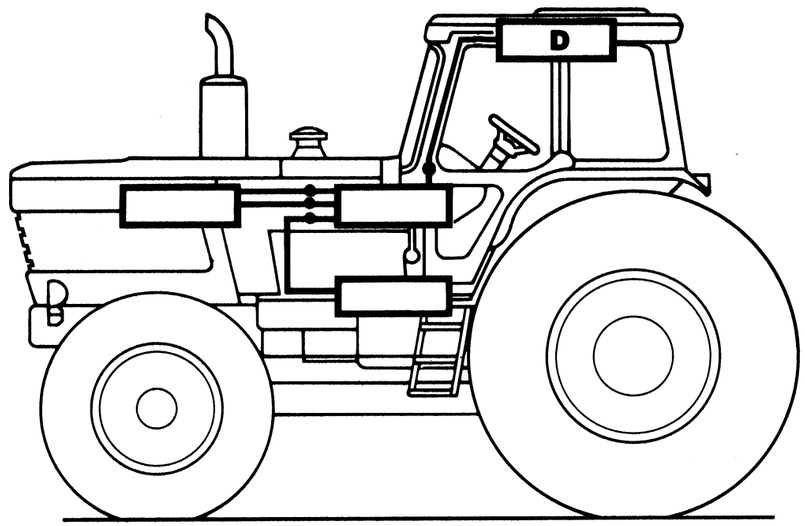
The complete tractor wiring diagrams are shown at the end of Chapter 6 – 'Electronic Instrument Panel'. Two isolated circuit diagrams are included to simplify fault finding in the following circuits:

Fault finding for electrical systems should be carried out in a logical and methodical fashion. A few minutes spent understanding the system and analysing the complaint can save considerable time.

Most systems can be thought of as a signal from a sensor or switch to a warning light or alarm. The basis of fault finding is to locate the part or point at which the signal stops or becomes corrupted.

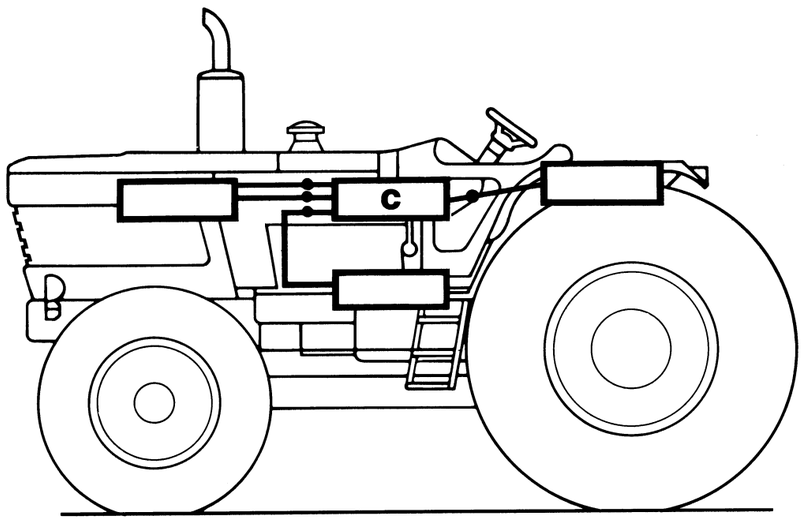
When checking the signal's passage through the system, it is usual to initially check that it is present at some point near the middle of the circuit. If it is present, continue checking towards the end, if it is not, go back towards the beginning until the signal is located.

When making an electrical connection or measurement, ensure the contact is made on clean bare metal which is free from paint, dirt or grease.



FORD 8530, 8630, 8730 and 8830 WITH CAB and WITH ELECTRONIC INSTRUMENT PANEL

D. CAB ROOF HARNESS HARNESS



FORD 8530, 8630, 8730 and 8830 LESS CAB and WITH MECHANICAL INSTRUMENT PANEL

C. INSTRUMENT CONSOLE HARNESS (MAIN REAR HARNESS)

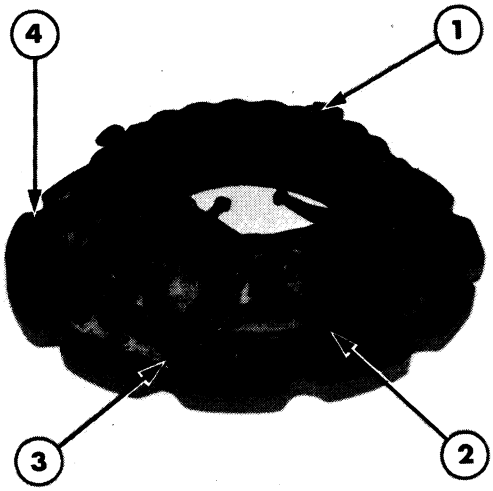


Figure 4
TW-5 Clutch Mounted on Base Plate of Tool No. FT.7110 (SW 12B)
1. Eyebolt Nut
2. Disc Spacer, Tool No. FT.7110-2/1 (SW 12B-2)
3. Bolt, Tool No. FT.7110/25 (SW 12B/25)
4. Base Plate, Tool No. STM 7704

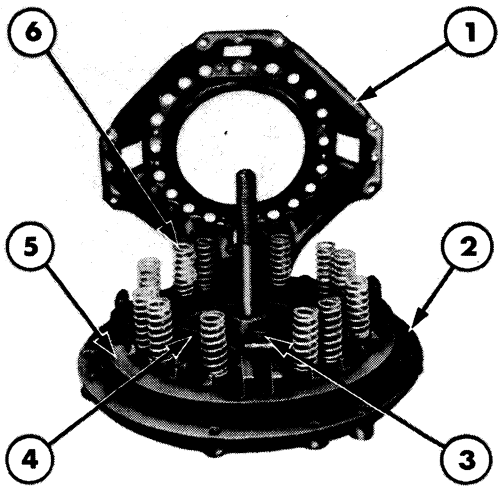


Figure 5
TW-5 Clutch Cover Removed
1. Clutch Cover
2. Fixture Base
3. Yoke
4. Release Lever
5. Pressure Plate
6. Pressure Springs

DISASSEMBLY USING TOOL NO. FT.7110 (SW 12B)

With reference to Figures 3 and 4.

1. Clean the pressure plate and cover assembly thoroughly then locate the assembly centrally on the base plate with the four clutch Disc Spacers, Tool No. FT.7110-2/1 (SW 12B-2) between the pressure plate and the base plate of the tool.

2. Secure the assembly to the base plate with the eight Special Bolts, Tool No. FT.7110/25 (SW 12B/25). Tighten the bolts evenly and diagonally across the clutch.

NOTE: *The clutch cover, pressure plate and all other major parts including springs, must be carefully marked and positions noted so that they may be returned to their original positions to maintain balance in the clutch.*

3. Remove the eight thrust plate bolts, four thrust plates and four release lever adjusting nuts from the cover.

4. Gradually slacken the bolts retaining the pressure plate cover to the base plate of the tool until all spring pressure is released then remove the bolts and the pressure plate cover.

NOTE: *The bolts must be slackened evenly and diagonally across the clutch to prevent distortion of the cover.*

5. Lift the clutch cover and remove the pressure springs from their locations on the pressure plate, Figure 5.

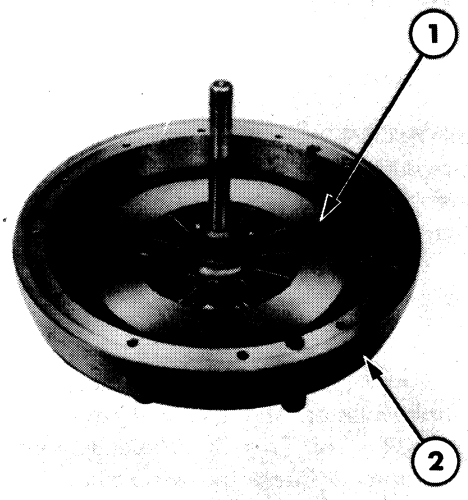


Figure 24
Adaptor Ring Installation
1. Fixture Base
2. Adaptor Ring, Tool No. 1194

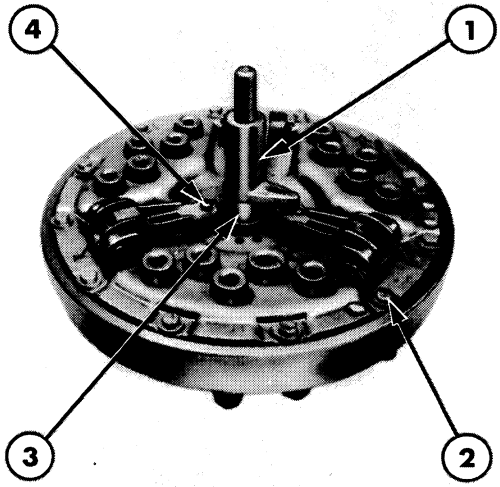


Figure 25
TW-15, TW-25 and TW-35 Clutch Release Lever Adjustment
1. Release Lever Gauge, Tool No. SW 510-2
2. Clutch Cover-to-Adaptor Ring Bolts
3. Gauge Spacer, Tool No. 1193
4. Release Lever Adjusting Screw

RE-ASSEMBLY AND ADJUSTMENT USING TOOL NO. 2142 (SW 510)

NOTE: *A new clutch assembly should be checked and, if necessary, adjusted. Follow Steps 8 — 12.*

1. Place the clutch pressure plate assembly on the clutch fixture base. Place all spring seats, washers, springs and spring cups on the pressure plate assembly as shown in Figure 18.

2. Install the release lever pins and levers on the clutch cover lugs.

3. Place the clutch cover and release lever assembly over the springs and align the reference marks previously noted during disassembly.

4. Install the bridge, thrust washer and spindle nut, Figure 21.

5. Centre the clutch assembly on the fixture base then tighten the spindle nut to compress the clutch mechanism until sufficient clearance is obtained so as to facilitate installation of the release lever clevis pins.

6. Install the four release lever springs, clevis pins, flat washers and new split pins, Figure 21.

7. Remove the spindle nut, thrust washer and bridge from the spindle. Remove the clutch pressure plate and cover assembly from the fixture base.

8. Use the three nuts and bolts to mount the Adaptor Ring, Tool No. 1194, on the fixture base, Figure 24. Securely tighten the bolts.

9. Position the clutch pressure plate and cover assembly on the adaptor ring and secure with the twelve clutch attaching bolts, Figure 25. Tighten the bolts evenly and diagonally across the clutch

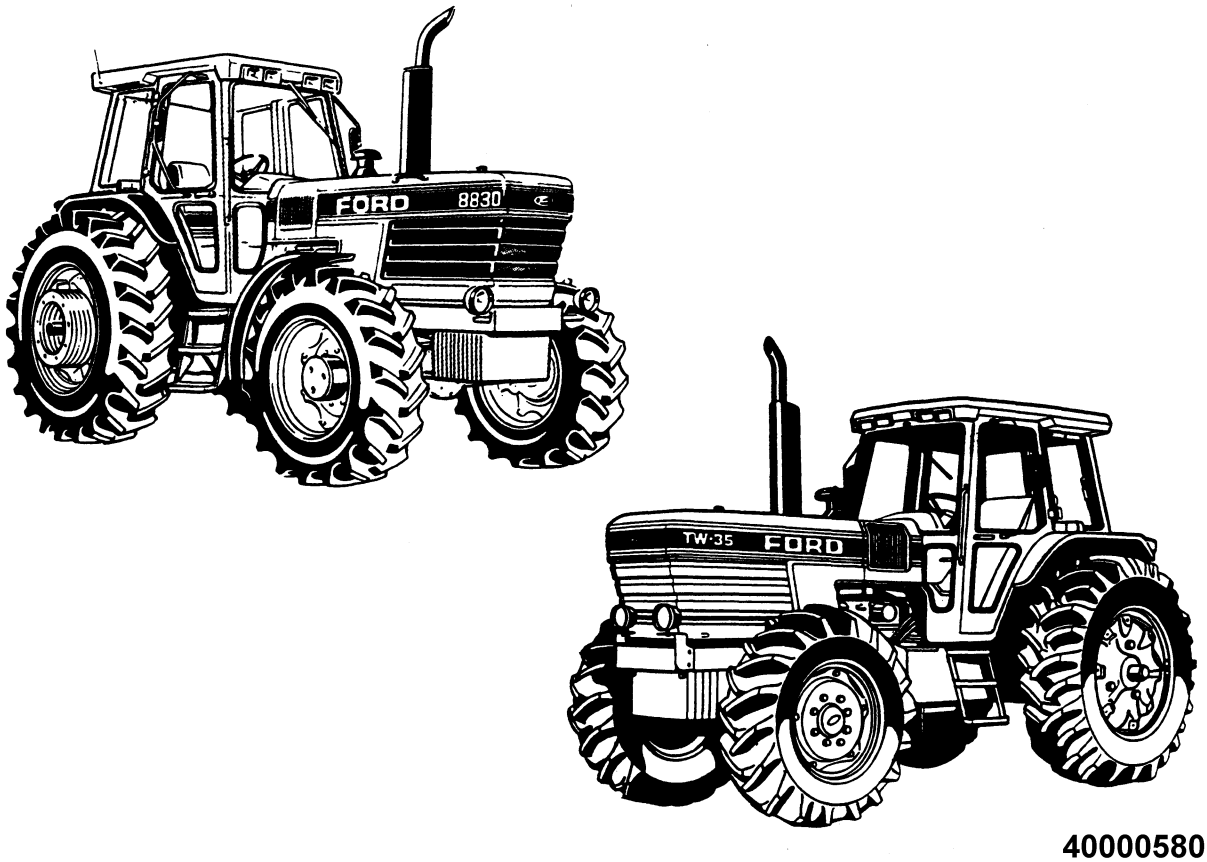
FORD

Service Manual

Tractors
TW5, TW15, TW25, TW35
8530, 8630, 8730, 8830

Part 5 – Transmission Systems

Vol. 3



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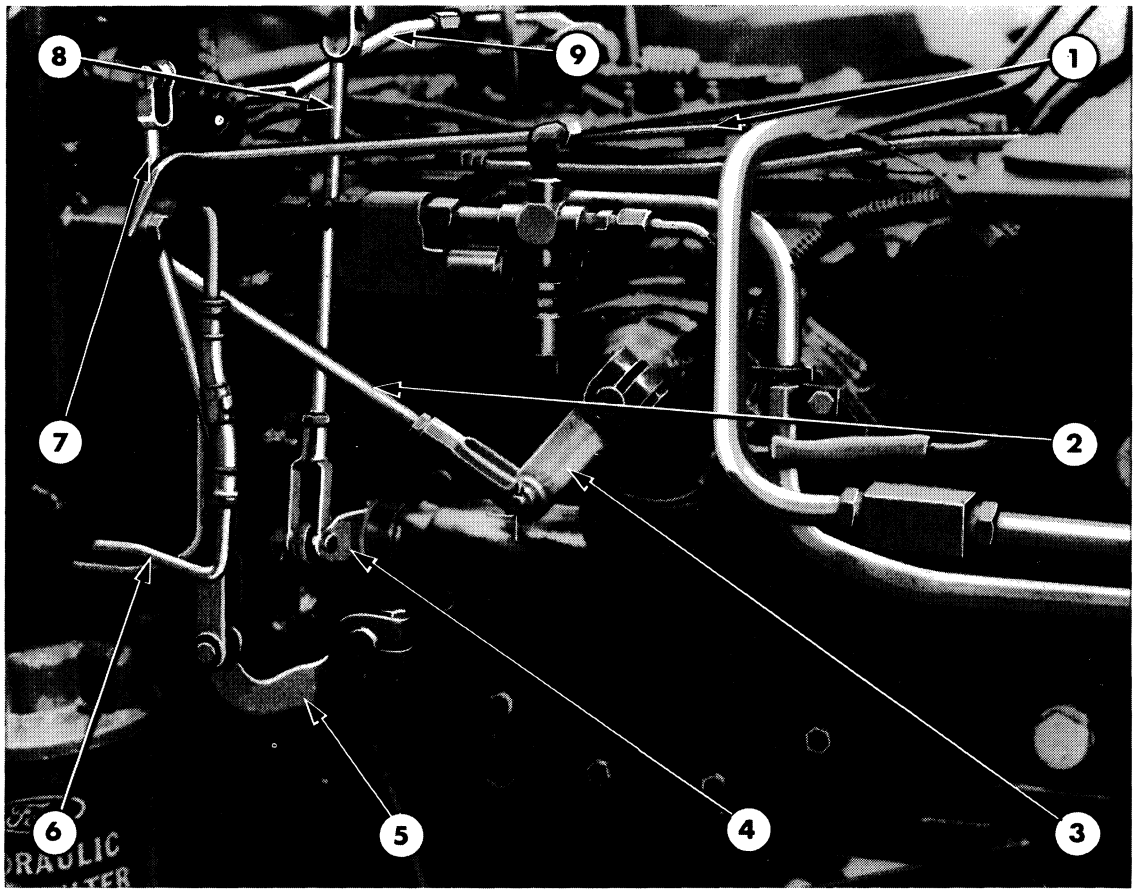


Figure 10
Gearshift Linkage

1. Support Brace
2. Gearshift Control Rod
3. Gearshift Arm
4. Lower Interlock Shift Arm
5. High/Low Shift Arm
6. P.T.O. Hydraulic Line
7. High/Low Control Rod
8. Interlock Control Rod
9. Parking Brake Control Rod

4. Loosen the trunnion bolt then gently tap to unseat and remove the parking brake bellcrank trunnion. Remove the trunnion bolt then use a punch to unseat and remove the high/low bellcrank trunnion. Remove the high/low selector lever assembly, high/low bellcrank and parking brake bellcrank. Note the order of the washers and shims to facilitate re-assembly.

5. Slide to remove the interlock pin from the locating bore, Figure 12.

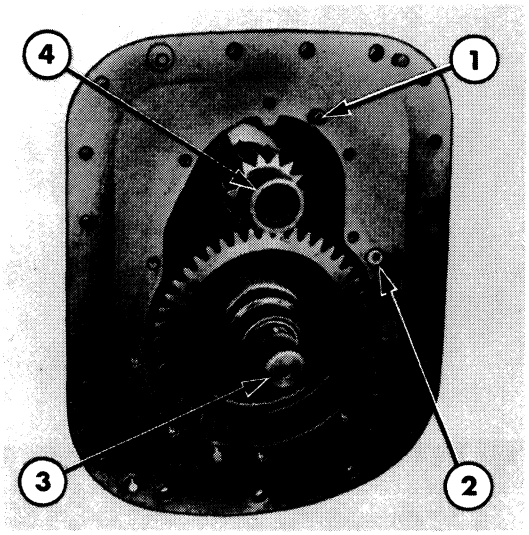


Figure 24
Secondary Countershaft Bearing Retainer Removed

1. Dowel Pins
2. Shift Rail
3. Output Shaft
4. Secondary Countershaft

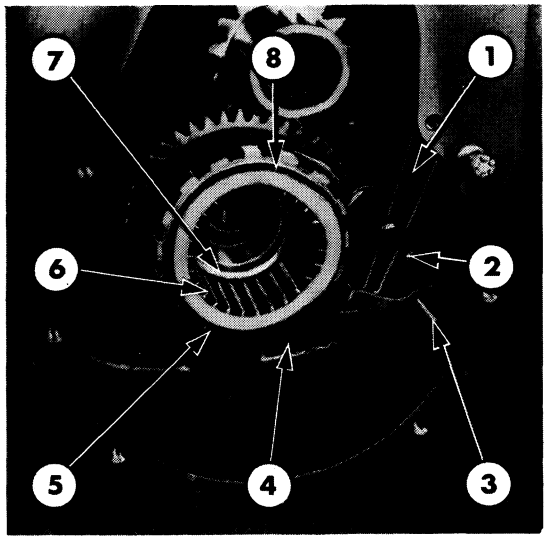


Figure 25
Sliding Coupling and Brake Pawl

1. Parking Brake Pawl
2. Shift Fork Bolt and Nut
3. High/Low Shift Rail
4. High/Low Shift Fork
5. Parking Brake Teeth
6. Internal Splines
7. Dog Teeth
8. High/Low Sliding Coupling

6. Remove the eleven bolts retaining the secondary countershaft bearing retainer, Figure 22. Insert two bolts in the jack screw holes and tighten evenly and alternately to avoid binding of the retainer.

NOTE: *Whenever a tractor is separated between the transmission and rear axle centre housing for any repairs, check to ensure all eleven bolts have been installed.*

7. Remove the six retaining bolts from the output shaft bearing retainer. Gently and evenly prise the retainer out to avoid binding and possible damage to the shims located behind the retainer. Remove the retainer shims.

8. Pull the output shaft assembly straight out to remove, Figure 24. Withdraw the secondary countershaft from the case. Remove the circlip and the thin needle thrust bearing from the front of the countershaft.

9. Remove the high/low gearshift sliding coupling from the shift fork fingers, Figure 25. Loosen the high/low shift fork lock nut and screw. Remove the high/low detent seat then remove the spring and ball, Figure 19. Use a magnet, if necessary, to remove the ball.

IMPORTANT: *The high/low detent assembly must be removed from the case to avoid damage to the detent spring when the high/low shift rail is installed.*

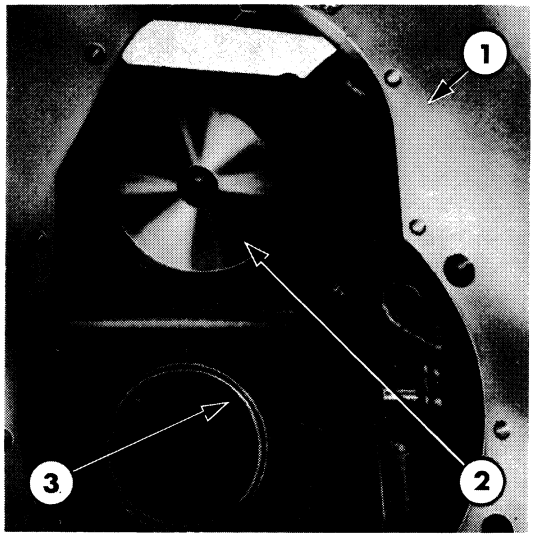


Figure 47
Installing Secondary Countershaft Bearing in Case

1. Transmission Case—Rear
2. Tool No. 9570
3. Main Countershaft Bearing Cup

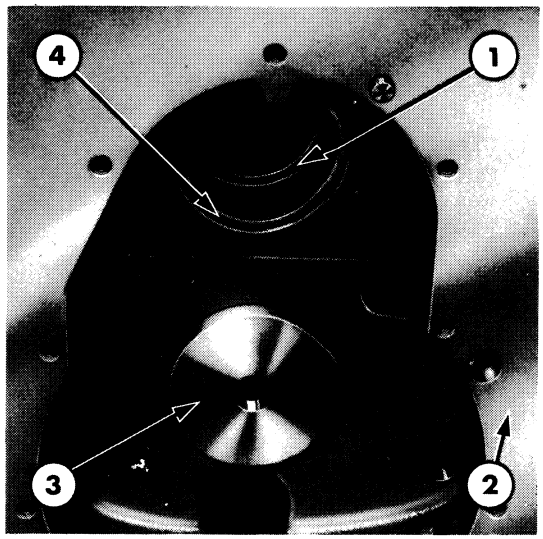


Figure 48
Installing Main Countershaft Bearing Cup in Case

1. Mainshaft Bearing
2. Transmission Case—Rear
3. Tool No. 9570
4. Secondary Countershaft Bearing

12. Inspect the rail for excessive wear or damage and install a new rail if needed.

13. Inspect the parking brake pawl and the three circlips for distortion, excessive wear or damage.

14. Inspect the shift fork detent springs and balls for wear. Compare the spring height with new springs. Replace, if necessary, for satisfactory detent function.

15. Inspect the control arm shaft and lever assembly for excessive wear or distortion and examine the lever for cracks, Figure 44.

16. Thoroughly clean the inside of the case then inspect for damage, cracks or distortion. If the case is beyond repair, install the transmission components in a new case.

17. Inspect the mainshaft and secondary countershaft bearings in the case for excessive wear or damage. Replace if necessary.

18. If necessary, use Bearing Plate, Tool No. 9570 to replace the secondary countershaft bearing in the case, as shown in Figure 47. If necessary, use Bearing Plate, Tool No. 976-4, to remove and replace the mainshaft bearing.

19. Inspect the main countershaft bearing cup for excessive wear or damage. If necessary, use Pulling Plate, Tool No. 970-2FC, to remove the cup. Use Bearing Plate, Tool No. 9570, to install a new cup, as shown in Figure 48.

20. Inspect the high/low control shaft bushing, located in the transmission case, for excessive wear. If necessary, use Step Plate, Tool No. 630S or 9210, to drive the bushing out through the case. Install a new bushing from outside the case, chamfered internal diameter end first in a similar manner.

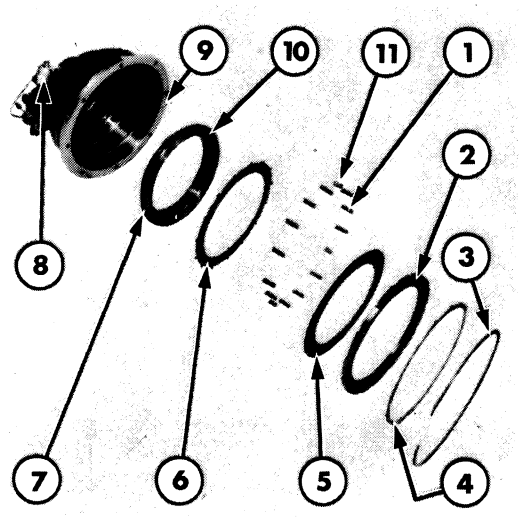


Figure 16
Underdrive Clutch Assembly — Exploded View
1. Piston Return Springs
2. Pressure Plate
3. Snap Ring
4. Spring Retainer
5. Friction Plate
6. Rear Plate
7. Piston Seals
8. Control Valve Body
9. Planetary Housing
10. Piston
11. Dowel Pins

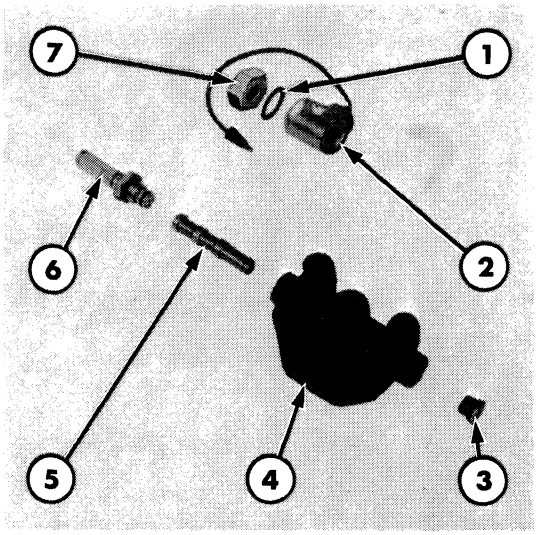


Figure 17
Control Valve Assembly
1. Washer
2. Solenoid
3. Plug
4. Valve Body
5. Valve Spool
6. Pilot Valve Assembly
7. Nut

Underdrive Clutch

1. Remove the large snap ring from the inner surface of the planetary housing.

NOTE: *To remove the snap ring it is recommended that four restraining clamps be made as shown in Figure 14. Equispace the four clamps, Figure 15, around the rim of the planetary housing and secure with the housing bolts.*

2. After removing the snap ring, gradually release the restraining clamps.

3. Remove the spring retainer, pressure plate and friction plate, Figure 16.

IMPORTANT: *Note the order in which the clutch plates were removed.*

4. Remove the piston return springs, locating dowel pins and rear plate.

5. Place an air hose nozzle in the pressure supply port of the control valve housing, and carefully blow out the underdrive piston.

IMPORTANT: *Position the planetary housing so that the underdrive piston cannot cause injury when expelled.*

6. Remove the inner and outer seals from the piston.

Control Valve Assembly

With reference to Figure 17.

1. Remove the plug located in the control valve at the opposite end to the solenoid.

2. Unscrew the retaining nut and remove the solenoid and washer.

3. Unscrew the pilot valve assembly and extract the control valve spool.

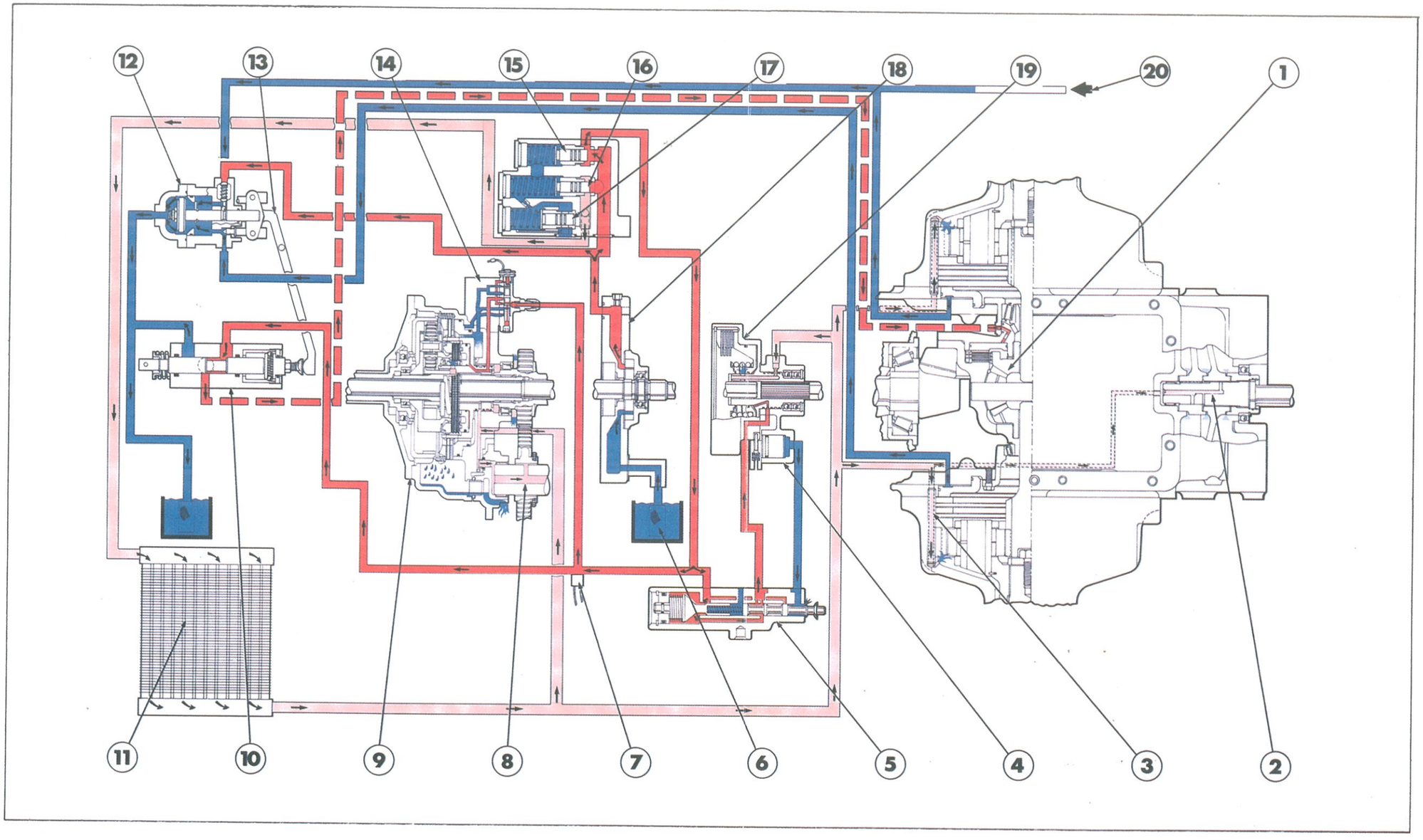


Figure 5
TW-35 Low Pressure Hydraulic System

System Pressure Oil

Lubrication Pressure Oil

Reservoir, Suction and Exhaust Oil

1. Differential Lock
2. P.T.O. Stub Shaft Lubrication
3. Final Drive Lubrication
4. P.T.O. Brake
5. P.T.O. Control Valve
6. Pump Intake Strainer
7. Transmission Oil Pressure Switch
8. Countershaft Needle Bearing Lubrication
9. Dual Power Assembly
10. Differential Lock Valve
11. Oil Cooler
12. Power Brake Valve
13. Brake/Differential Lock Interlink
14. Dual Power Control Valve
15. Brake Priority Valve
16. System Pressure Regulating Valve
17. Lubrication Pressure Valve
18. Gerotor Pump
19. P.T.O. Clutch
20. From Trailer Brake Valve

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
4. Dual Power system pressure too high in both underdrive and direct drive	1. Extremely cold oil in rear axle centre housing.	1. Operate tractor to warm oil.
	2. Low pressure hydraulic system pressure regulating valve spool stuck closed or spring too stiff. Plugged 0.043 in (1.09 mm) diameter orifice located in valve body between system pressure regulating valve and lubrication pressure valve spring chambers.	2. Remove low pressure hydraulic system regulating valve assembly from the right hand side of the transmission. Remove, clean and inspect the spring and valve spool. Refer to Page 6, "LOW PRESSURE HYDRAULIC SYSTEM" — Chapter 3.
5. No power to rear wheels when direct drive engaged (underdrive operative)	1. Low Dual Power system pressure in direct drive clutch circuit.	1. See possible causes listed with problem 1.
	2. Scored, burred or binding direct drive piston	2. Remove and disassemble direct drive clutch, Page 6, Chapter 2. Check piston for score marks and burrs.
	3. Worn or defective direct drive clutch plates.	3. Remove and disassemble direct drive clutch, Page 6, Chapter 2. Check plates.
	4. Direct drive clutch pressure plate snap ring out of groove or broken.	4. Remove direct drive clutch, Page 6, Chapter 2. Check snap ring position.
	5. Damaged or broken direct drive clutch pressure plate.	5. Remove and disassemble direct drive clutch, Page 6, Chapter 2. Check for broken or damaged pressure plate.

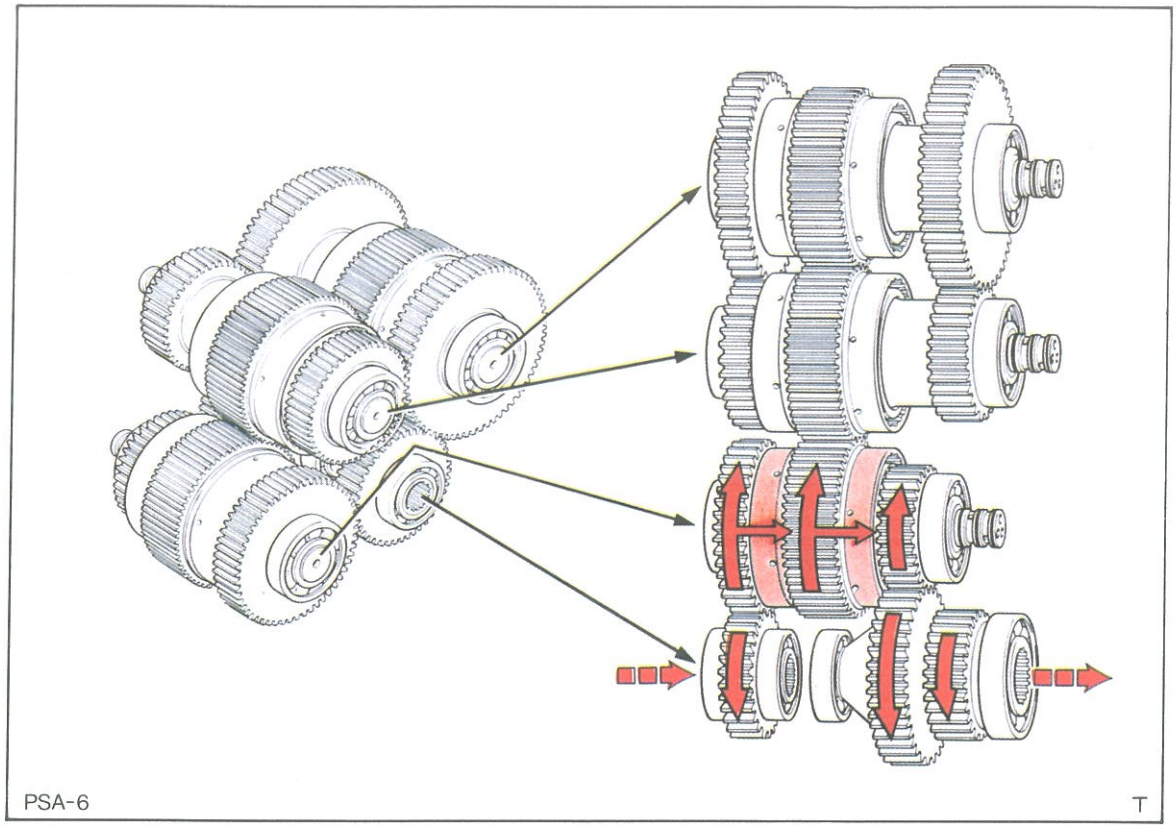


Figure 6
Power Flow in Front Housing for 2nd. Speed – Speed Clutches 2 and A Applied

the front gear of the two gears on the front housing output shaft, which transfers the power flow to the rear housing components.

Gear ratio is:– 65/42 x 71/71 x 71/71 x 56/40 = 2.167

2nd– Speed Clutch 2 and Clutch A applied Figure 6

Power flows from the input gear to speed clutch assembly 2/A. Clutch 2 and clutch A are applied, and consequently power flows from one end gear to the other, and drives the front gear of the output to the rear housing.

Gear ratio is:– 55/42 x 56/40 = 1.833

3rd Speed– Clutch 3 and Clutch A applied Figure 7

Power flows from the input gear to the end gear of speed clutch assembly 1/C. The end gear is in mesh with the end gear of speed clutch assembly 3/B. Clutch 3 is applied and locks the end gear to the central gear, which in turn drives the central gear of speed clutch assembly 2/A. Clutch A is applied which locks the end gear to the central gear and power is transferred to the front gear on the output to the rear housing.

Gear ratio is:– 65/42 x 47/65 x 71/71 x 56/40 = 1.567

4th Speed – Clutch 1 and Clutch B applied Figure 8

Power flows from the input gear to the end gear of speed clutch assembly 1/C. As clutch 1 is applied power is transferred to the central gear. Speed clutch assembly 1/C central gear is in mesh with the central gear of speed clutch assembly 3/B. Clutch B is applied and power is transferred to the end gear. This end gear is in mesh with the end gear of speed clutch assembly 1/C, which in turn meshes with the rear gear on the output shaft to the rear housing.

Gear ratio is:– 65/42 x 71/71 x 70/43 x 38/70 = 1.368

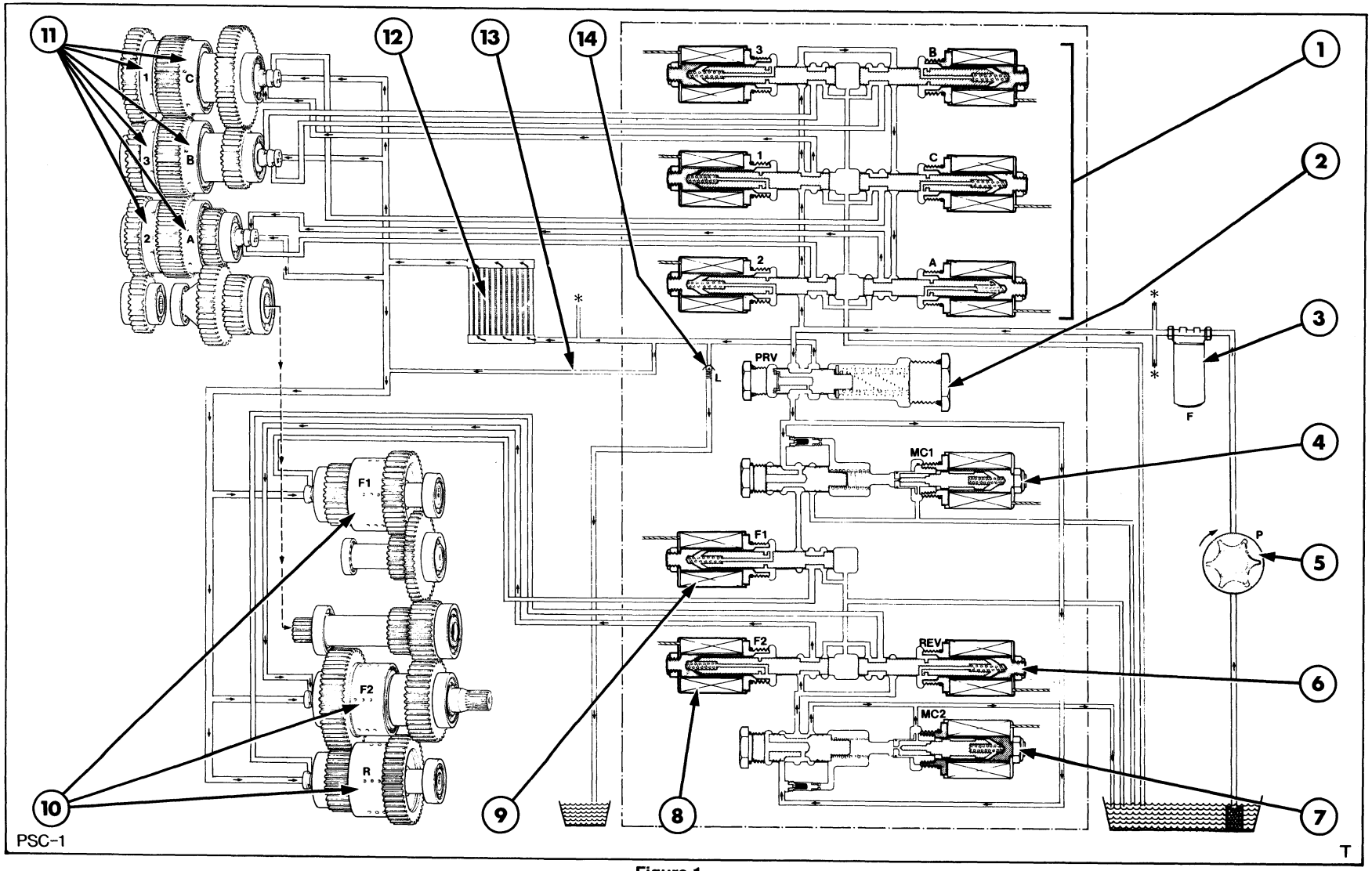


Figure 1
Main Hydraulic Control Valve Circuits – Schematic View

1. Speed Clutch Circuit Valves x 6
2. Regulating Valve
3. Filter
4. Modulator Valve for F1 Clutch
5. Pump
6. Reverse Clutch Circuit Valve
7. Modulator Valve for F2 and REV
8. F2 Clutch Circuit Valve
9. F1 Clutch Circuit Valve
10. Directional Clutches
11. Speed Clutches
12. Oil Cooler
13. Internal By–pass
14. Lubrication and Cooling Relief Valve

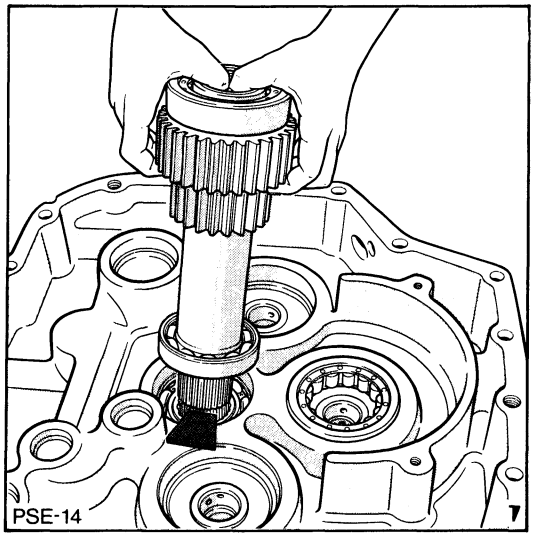


Figure 14
Removing the Wedged Transfer Shaft

Disassembly of the rear housing components (directional clutches) is now complete. If repair of the removed assemblies is now necessary, refer to the following headings covering overhaul of these items. If further disassembly is required it is recommended that complete transmission disassembly is completed before overhauling sub–assemblies.

Front Housing and Speed Clutches – Removal

1. Screw in three lifting eyes into the threaded holes provided in the centre section. (thread size 3/4–10 U.N.C.) Using a suitable lifting sling, carefully lift the centre section away from the front housing, Figure 15. Remove the gasket.

2. In order to remove speed clutches 1/C and 3/B it will be necessary to construct a simple lifting attachment. Refer to Figure16 for constructional detail.

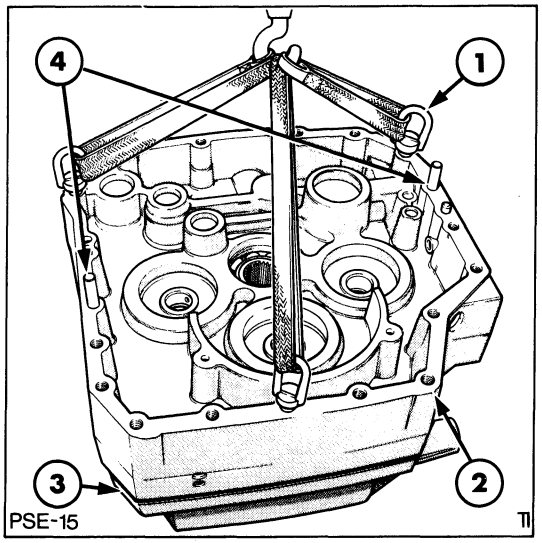


Figure 15
Lifting Centre Section away from Front Housing

1. Lifting Eye
2. Centre Section
3. Front Housing
4. Guide Rods

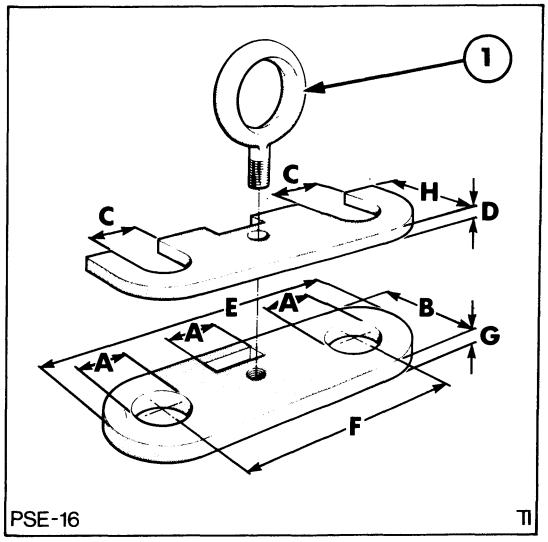


Figure 16
Speed Clutches 1/C and 3/B Lifting Tool – Constructional Detail

1. Suitable Lifting Eye
A. 1.5 inch
B. 3.0 inch
C. 1.235 inch
D. 0.312 inch
E. 9.0 inch
F. 7.0 inch
G. 0.5 inch

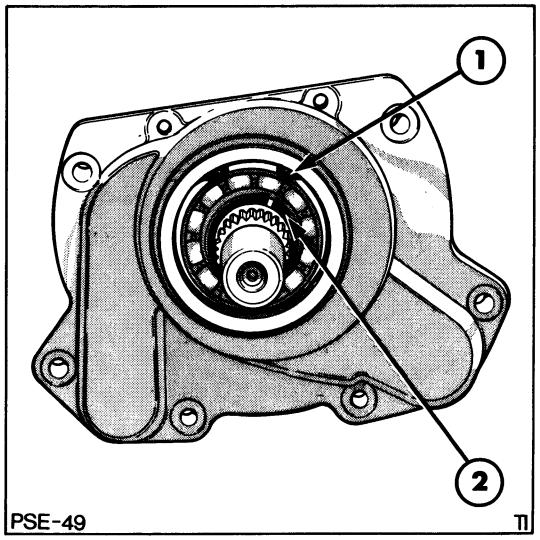


Figure 49
P.T.O. Shaft Rear Bearing Snap Rings

1. Bearing to Housing Snap Ring
2. Bearing to Shaft Snap Ring

to the wall thickness of the sleeve, Figure 47. It is important during removal that the bore in the centre section is not damaged.

6. Install new sleeves using a suitable step plate adapter. Ensure that the oil holes in the sleeve line up with the holes in the centre section before driving in the sleeves, Figure 48.

Oil Pump and PTO Shaft Assembly, Disassembly, Inspection and Reassembly

1. Remove the inner and outer snap rings retaining the P.T.O. shaft rear bearing to the shaft and oil pump housing, Figure 49.

2. Gently tap the forward end of the P.T.O. shaft onto a wooden block to push the bearing out from the oil pump housing.

3. Using puller no. 1003, or 9516, and a suitable shaft protector, pull off the bearing from the shaft, Figure 50, and remove the second snap ring from the shaft

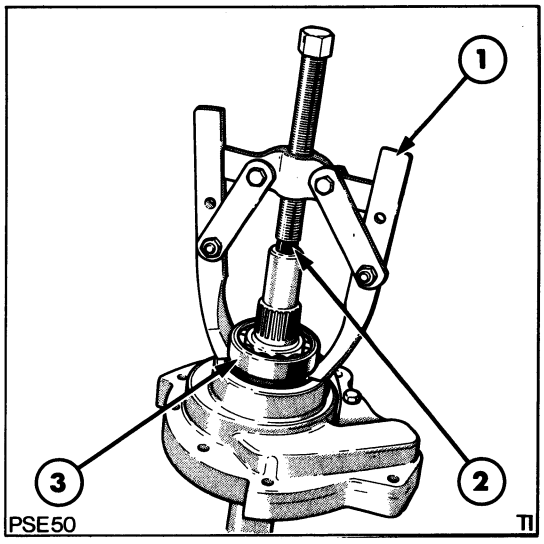


Figure 50
Pulling Off P.T.O. Shaft Rear Bearing

1. Puller No. 1003 or 9516
2. Shaft Protector
3. Bearing

4. The P.T.O. shaft can now be removed from the pump.

5. Remove the 4 bolts retaining the two half housings and separate the pump rotor from the housings, an exploded view is shown in Figure 51.

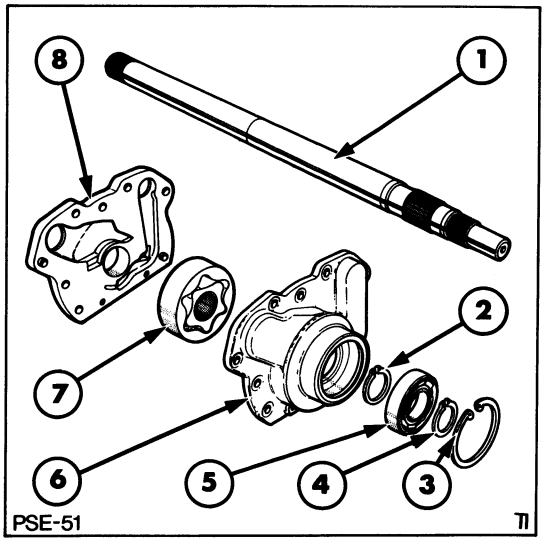


Figure 51
Hydraulic Pump – Exploded View

1. PTO Shaft
2. Snap Ring
3. Snap Ring
4. Snap Ring
5. Bearing
6. Pump Rear Housing
7 Rotor Assembly
8 Pump Front Housing

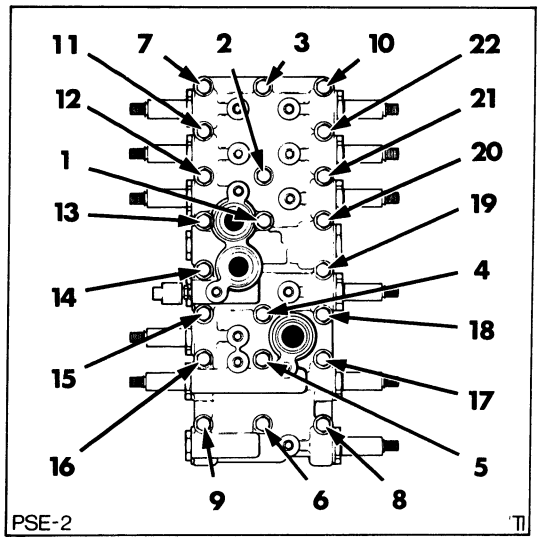


Figure 4
Control Valve Retaining Bolt Loosening Sequence

Loosen and remove in the sequence shown starting with bolt No. 22

4. Disconnect and release the four separate harnesses connecting the solenoids to the main control circuit harness, Figure 2.

5. Disconnect the pump oil tube from the transmission filter and the inlet port of the control valve and remove the tube, Figure 3.

6. Disconnect the low pressure circuit supply tubes leading to the tractor P.T.O., brake, four wheel drive engagement clutch, and lubrication circuits, Figure 3. If necessary disconnect these tubes at the opposite ends to provide access and clearance during valve assembly removal.

7. Disconnect the cooler to control valve tube from the valve, Figure 3, if necessary loosen or remove the tube to provide access.

8. Following the numbered sequence shown in Figure 4, loosen each of the 22 retaining bolts, start with bolt no. 22, and progressively loosen in decreasing order. Remove all but two bolts.

9. With the help of an assistant, support the valve assembly and remove the last two bolts. Carefully remove the control valve ensuring the solenoid harnesses are not snagged or caught.

DISASSEMBLY

Disassembly of the control valve embraces removal of the six speed clutch circuit valves and the three directional clutch circuit valves. All these nine valves are identical in the disassembly procedure. In addition, the two modulator valves for directional clutch control are similar and the same respective procedure applies to both. The remaining regulating valve is unique in its removal procedure.

Before commencing disassembly consider if the whole assembly requires inspection or overhaul, if it is required or suspected that this is the case then remove all solenoids and harnesses to avoid accidental damage. If only one or two circuits are suspect, then individual solenoids may be removed.

CONTROL PRESSURE TEST MODES

This test procedure consist of two modes:

50 lbf/in² (3.45 bar) Test Mode and Multiple Pressure Test Mode

It is possible to sequentially move from the first mode to the next. To exit any Test Mode, Power–down and again Power–up in a normal manner.

50 lbf/in² (3.45 bar) Test Mode

To enter this mode, power–up with the speed control lever in **forward upshift** and the inching pedal **released**.

IMPORTANT NOTE: *F1 and F2 direct acting solenoids will be turned on in this mode. Therefore, caution should be used when operating in this mode. If one or more "letter" clutches A, B, or C and one or more "Number" clutches 1, 2, or 3 are pressurised, the tractor could stall or move. It is recommended that the parking brake be applied and the "Number" clutches be disconnected (Disconnect the connector C9 as illustrated in Section B, associated with I, 2, 3, and CR).*

When in this mode, the TCM cycles pressure to both clutches (F1 and F2) between 50 lbf/in² (3.45 bar) and "LP" (low pressure – up to 25 lbf/in² (1.7 bar)). The normal cycle time is 2 seconds for "LP" and 7 seconds for 50 lbf/in² (3.45 bar).

MC1 and MC2 can during this cycling be checked to verify that clutch pressure is between 30 and 70 lbf/in² (2–4.3 bar). The two pressures can be checked at the ports on the valve body marked "F1" and "F2".

The pressures should be read using the specified pressure gauge, see Specifications at the end of this chapter, when the display shows 50 lbf/in² (3.45 bar). The "LP" pressure is a part of the test cycle to guarantee that the nominal 50 lbf/in² pressure is approached from the same direction to give predictable hysteresis.

Pressure measurements at ports "F1" and "F2" give clutch pressures – not PWM pilot pressures.

The cycle time can be lengthened by a factor of 6 by moving the speed control lever to downshift.

Multiple Pressure Test Mode

To sequence from the 50 lbf/in² (3.45 bar) Test Mode to the Multiple Pressure Test Mode, move the speed control lever from **forward** to **neutral** and back to **forward**. It is then possible to manually cycle between "LP" (low Pressure – up to 25 lbf/in² (1.7 bar)), 50 (3.45 bar) and 90 lbf/in² (6.2 bar) by using upshift and downshift.

Inching Pedal, Software Version and Solenoid Test Mode

To enter this mode, power up with the speed control lever in **forward downshift** and the inching pedal **released**.

IMPORTANT NOTE: *F1 and F2 direct acting solenoids will be turned on in this mode. Therefore, caution should be used when operating in this mode. If one or more "Letter" (A, B, or C) clutches and one or more "Number" (1, 2, or 3) clutches are pressurised, the tractor could stall or move. It is recommended that the hand brake be applied and the "Number" clutches be disconnected (Disconnect the connector associated with 1, 2, 3, and CR).*

B3. Powershift Front Console to Transmission Harness Connector

Pin	Colour	Circuit Code	Description
1	W/Y	1000E	Neutral Start Switch Supply
2	W/Y	1000F	Neutral Start Switch Supply
3	B	57	Earth
4	R/LG/B	7070A	Transmission Feed
5	B	7570A	Signal Earth
6	U/R/B	7000A	Transmission Control Supply
7	Y/P/B	7420	TCM Regulated Voltage to Inching Pedal
8	Y/R/B	7430	Inching Pedal Position Signal
9			Not used
10			Not used
11	R/LG/B	7070V	Transmission Feed
12	R/LG/B	7070U	Transmission Feed

B5. Inching Pedal Switch Connector

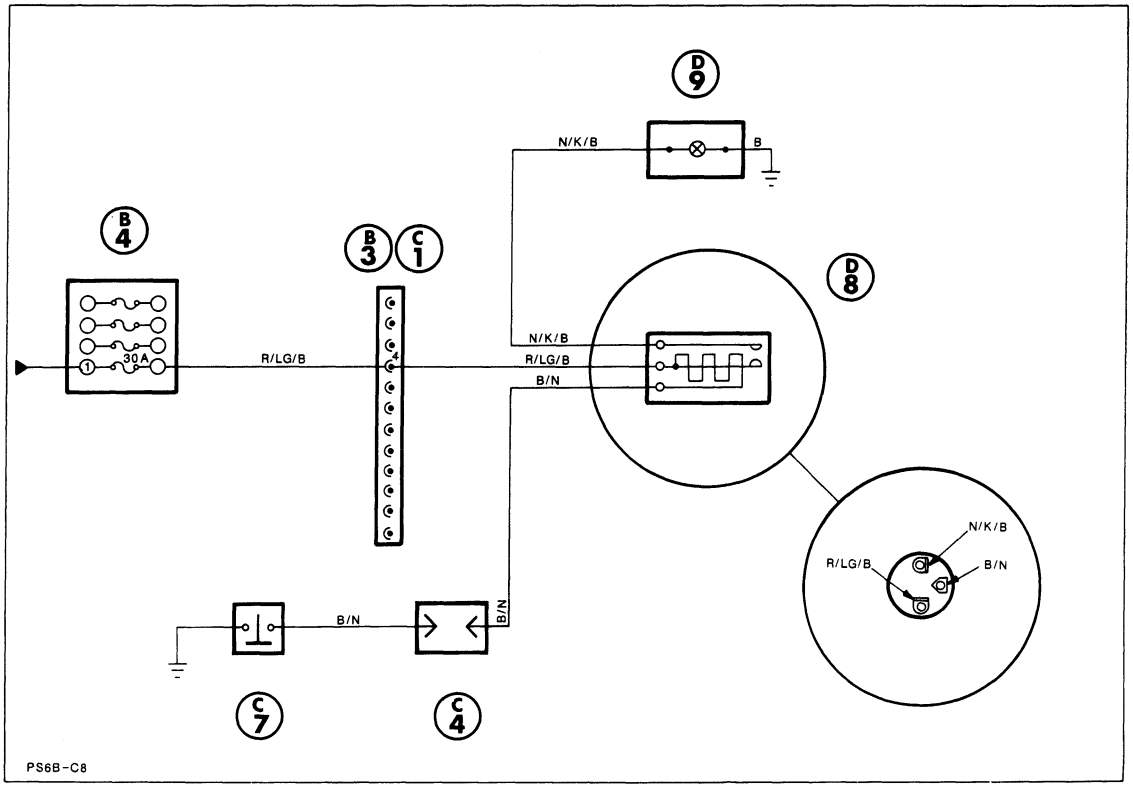
Pin	Colour	Circuit Code	Description
1	U/R/B	7000A	Transmission Control Supply
2			Not used
3	U/R/B	7000	Transmission Control Supply
4			Not used

B7. Inching Pedal Position Potentiometer Connector

Pin	Colour	Circuit Code	Description
1	Y/R/B	7430	Inching Pedal Position Signal
2	Y/P/B	7420	TCM Regulated Voltage to Inching Pedal
3	B	7570A	Signal Earth

B8. Transmission Power Relay Connector

Pin	Colour	Circuit Code	Description
1	R/LG/B	7070	Transmission Feed
2	W	71	Keystart Switched Feed (not fused)
3	B	57B	Earth
4	R/LG/B	7070C	Transmission Feed
5			Not used



Circuit 8

Oil Filter Restriction Warning Light Circuit

B3 Powershift Front Console toTransmission Harness Connector
Connects into Transmission Harness Connector C1
B4 Auxiliary Fuse Box (30 Amp Fuse)
C1 Transmission to Powershift Front Console Harness Connector
Connects into Powershift Front Console Harness Connector B3
C4 Transmission Low Oil Temperature Switch in Transmission Control Valve
C7 Oil Filter Restriction Switch
D8 Oil Filter Warning Light Delay Switch
D9 Oil Filter Restriction Warning Light

Note: For items with prefix 'B' refer to Figures 2 and 7
For items with prefix 'C' refer to Figures 3 and 8
For items with prefix 'D' refer to Figure 4

3. No drive in only one speed. Re–check Display, an Error Code should be showing indicating an electrical fault.

4. No drive in reverse R4 but drive is in F4. Other reverse speeds are present but not all. Study chart noting that R4 uses clutches 1 and A, whereas F4 uses 1 and B. Recheck transmission characteristics. No drive should exist in speeds F1, F2, F3, F10, F11, F12, R4 (complaint speed) R5 and R6.

From analysis of the Clutch Application Chart it should now have led to a positive diagnosis of the fault. If it is suspected that a speed clutch is defective, remember that these clutches are not modulated, so the hydraulic modulation valves MC 1 and MC 2 should not be suspected. Before stripping down the transmission check the applicable speed clutch circuit valve, 1, 2, 3, or A, B, C, (marked on the outside of the main control valve casting) for mechanical defect or contamination. Refer to Chapter 5 Section G.

If it is suspected that a directional clutch is at fault, again before stripping down the transmission, inspect the modulating valves. MC 1 for faults with speeds F1 – F9, and MC 2 for faults with speeds F10 – F18 and all reverse. If only F10 – F18 speeds are at fault but not any reverse, then the directional clutch circuit valve should be inspected. Refer to Chapter 5 Section G. In the case of F1 – F9 then inspect the modulating valve MC 1 first. If this is unsuccessful, then inspect the F1 clutch circuit valve.

Any major repair to the internal components of the transmission should, on no account be considered, until every involved component, be it, hydraulic, electrical or electronic has been checked, re–checked and eliminated as being the cause of the fault.

In the preceding tables covering Error Codes the "Post Power–Up Diagnostics" column contains codes such as #1, #2 etc. The following notes explain these codes:–

#1. Post Power–Up Diagnostic Error Codes appear after electrical power is applied. Generally, some action such as Tractor movement, Inching Pedal movement, or Speed Control Lever movement causes these to appear.

#2. Error Codes such as C7, C8, and C11 appear when the Speed Control Lever is moved from Neutral to Forward or Reverse. Solenoids F1, F2, and R do not have +12V applied to them in Neutral.

#3. These Error Codes appear when the tractor starts to move.

#4. Error Codes C7, C8, and C11 appear when the Inching Pedal is depressed and the Speed Control Lever is moved from Neutral to Forward or Reverse.

#5. Error codes P5, C7, C8, and C11 appear if the Inching Pedal is depressed and then released with a +12v short on wire(s) to TCM Pin 8 or 17.

#6. P3 will usually only appear if the Inching Pedal is depressed during the Power–Up when the Inching Pedal is mis–adjusted.

#7. P4 will usually only appear if the Inching Pedal is fully released during the Power–Up when the Inching Pedal is mis–adjusted.

#8. If P4 appears when the the Inching Pedal is released, P5 may likely appear when the Inching Pedal is depressed and P4 will likely disappear.

#9. Since the Inching Pedal Switch appears to the TCM to be always open (P5 Error Code), the TCM tries to turn on Solenoids either F1, F2, or R resulting in open circuit Error Codes.

#10. P5 appears only when the Speed Control Lever is moved from Neutral to Forward or Reverse.

#11. Error codes P5, C7, C8, and C11 may or may not appear when the Inching Pedal is depressed depending upon the degree of mis–adjustment of the Inching Pedal Position Sensor.

#12. P6 will only appear when the Inching Pedal is depressed and the Speed Control lever is in Forward or Reverse.

STEP	QUESTION AND INSTRUCTION	GO TO STEP IF YES	GO TO STEP IF NO	COMMENTS
E65	The wire from the TCM to the Solenoid appears not to be shorted to +12V. Measure the resistance between Pins 1 and 3 of the Solenoid side of the hyd. valve right hand 4 Pin Connector C12 (this is the resistance of Solenoid coil MC2). Is the resistance approx. 1.8 ohms?	E66	E69	This test determines if the Solenoid coil is shorted. It should not measure less than 1.6 ohms at a temperature above 40°F. (+5°C) See further Solenoid Test procedure, page 167. The resistance will increase slightly with temperature.
E66	Does the blue wire from the Solenoid coil go to Pin 1 of the hyd. valve right hand 4 Pin Connector C12?	E67	—	This verifies that the Solenoid is not installed backwards. The blue wire should always go to the +12V.
E67	The wiring harness does not indicate any +12V short problems. The Solenoid could be defective even though it measures the correct resistance. The TCM could also be defective. As a final check of the harness, measure the resistance from Pin 25 to all other Pins of the harness side of the TCM Connector D3 (unplugged from the TCM) with the hyd. valve right hand 4 Pin Connector C12 unplugged. Does it show open circuit on all tests?	—	—	If yes , suspect the Solenoid coil or the TCM. If no, trace Wire 7393 for shorts. It should not connect to any other circuit and therefore should show open circuit to any other pin.
E68	With the hyd. valve right hand 4 Pin Connector C12 unplugged and a short showing between Pin 25 and 16 of the TCM Connector D3 (harness side unplugged from the TCM), wire 7393 or its terminals must be shorted somewhere to +12V. Trace and inspect the wire and its terminals for shorts to adjacent wires or terminals.	—	—	If it becomes difficult to find the short, monitor the multi–meter as the cable or harness is flexed and moved for some clue as to where the short exists.
E69	Suspect a defective Solenoid or its terminals in the connector C12	—	—	

STEP	QUESTION AND INSTRUCTION	GO TO STEP IF YES	GO TO STEP IF NO	COMMENTS
E147	With the TCM disconnected, the magnetic field still can be felt at Solenoid coil A as the Keystart is turned ON and OFF. This implies a short to Earth on the wire from the Solenoid coil to the TCM Harness Connector D3. Disconnect hyd. valve right hand 8 Pin Connector C11 at the valve body. Measure the resistance from the Harness side of TCM Connector D3 Pin 20 to Earth. Does it measure an open circuit?	E149	E148	
E148	A short exists on Wire 7361 or 7361A to Earth. Disconnect the System Connector D6. Measure the resistance from the Harness side of the TCM Connector D3 Pin 20 to Earth. Does it measure open circuit?	E156	E157	If the short is difficult to locate, monitor the multi–meter as set up in step E147 while moving and flexing this wire.
E149	Unless the problem is intermittent and conditions are changing, everything points to the Solenoid coil A and its terminals as the problem. To confirm, measure the resistance from Pin 7 of the valve right hand 8 Pin Connector C11 (valve side) to Earth. A short circuit here confirms the problem.	—	—	If this test can not confirm the problem, the defect must be intermittent. Repeat step E147 while flexing wire 7361 and 7361A. Look for any possible short to Earth on the return side of the Solenoid coil (Black lead of coil). Inspect Pin 8 of the System Connector D6 (both ends).
E150	The problem appears to be an open circuit and not a short. Disconnect the TCM Harness Connector D3 from the TCM. Measure the voltage at Pin 20. Is the voltage +12V (battery voltage)	E93	E151	This test may give erroneous information if a high resistance connection exists that allows +12V to appear here but won't carry the coil current. If "Yes" and replacing the TCM does not solve the problem, repeat this step only load the voltmeter with a replacement Solenoid coil (Blue lead to +ve lead of voltmeter and black lead to Earth or –ve lead of voltmeter). The voltage should read approx. 1/2 of +12V (Battery voltage). If it falls to approx. 0, a high resistance connection exists. If that is the case, proceed with step E151 using the load across the voltmeter. In step E151, the voltage should read +12V even with the coil loading the voltmeter.

STEP	QUESTION AND INSTRUCTION	GO TO STEP IF YES	GO TO STEP IF NO	COMMENTS
E229	Turning the Keystart ON and OFF (Cycling system power ON and OFF), "feel" the end of the Solenoid coil F2 with a screwdriver or similar metal instrument. Does the magnetic field change when power is applied?	E230	E237	The Error Code can be the result of three different situations – an open circuit or high resistance where no or too little coil current flows, a short to Earth where the coil is always energised but the current does not flow through the TCM, or a defective TCM. This test helps sort out which condition exists. If a magnetic field is present, a short to Earth or defective TCM must exist since the coil should not be energised.
E230	A short to Earth or a defective TCM must be energizing the coil. Disconnect the TCM Harness Connector D3 from the TCM and repeat the test described under E229. Does the magnetic field change when power is applied?	E234	E231	This test determines if the current is flowing through the TCM or is an external short to Earth.
E231	Measure the resistance of Solenoid coil F2. Does it measure approximately 1.8 ohms?	E88	E87	See further Solenoid Test procedure, page 167.
E234	With the TCM disconnected, the magnetic field still can be felt at Solenoid coil F2 as the Keystart is turned ON and OFF. This implies a short to Earth on the wire from the Solenoid coil to the TCM Harness Connector D3. Disconnect hyd. valve left hand 4 Pin Connector C10 at the valve body. Measure the resistance from the Harness side of TCM Connector D3 Pin 24 to Earth. Does it measure an open circuit?	E236	E235	

STEP	QUESTION AND INSTRUCTION	GO TO STEP IF YES	GO TO STEP IF NO	COMMENTS
E310	Turning the Keystart ON and OFF (Cycling system power ON and OFF), "feel" the end of the Solenoid coil CR (creeper) with a screwdriver or similar metal instrument. Does the magnetic field change when power is applied?	E311	E318	The Error Code can be the result of three different situations – an open circuit or high resistance where no (or too little) coil current flows, a short to Earth where the coil is always energised but the current does not flow through the TCM, or a defective TCM. This test helps sort out which condition exists. If a magnetic field is present, a short to Earth or defective TCM must exist since the coil should not be energised.
E311	A short to Earth or a defective TCM must be energizing the coil. Disconnect the TCM Harness Connector D3 from the TCM and repeat the test described under E310. Does the magnetic field change when power is applied?	E315	E312	This test determines if the current is flowing through the TCM or is an external short to Earth.
E312	Measure the resistance of Solenoid coil CR. Does it measure approximately l.8 ohms?	E314	E313	See further Solenoid Test procedure, page 167.
E313	Defective Solenoid Coil.	—	—	See further Solenoid Test procedure, page 167.
E314	Defective TCM.	—	—	The TCM is causing the coil to energise but the unit shows open circuit. The coil appears not to be defective.
E315	With the TCM disconnected, the magnetic field still can be felt at Solenoid coil CR as the Keystart is turned ON and OFF. This implies a short to Earth on the wire from the Solenoid coil to the TCM Harness Connector D3. Disconnect the hyd. valve left hand 8 Pin Connector C9 at the valve body. Measure the resistance from the Harness side of TCM Connector D3 Pin 29 to chassis Earth. Does it measure an open circuit?	E317	E316	

STEP	QUESTION AND INSTRUCTION	GO TO STEP IF YES	GO TO STEP IF NO	COMMENTS
E391	Suspect Wire 7000A between the Inching Pedal Switch Connector B5 (Pin 1) and the Transmission to Front Console Harness Connector B3 (Pin 6) along with its terminals.	—	—	No voltage change was noted previously at Pin 6 on the Transmission to Front Console Harness Connector B3. However, +12V is present at the Inching Pedal Switch Connector B5 (Pin 3) and the switch was good with a multimeter test. Connector contacts are always a possible fault.
E392	Reconnect the Transmission to Front Console Harness Connector. B3/C1 Disconnect the Speed Control Lever assembly Connector D11 and monitor the voltage on Pin 1 of this Connector (Harness side). Does the voltage go to +12V when the Inching Pedal Switch is closed (Inching Pedal released) and approx. 0V when the switch is open (Inching Pedal depressed)?	E394	E393	The signal was good at Pin 6 of the Transmission to Front Console Harness Connector B3 in a previous test. The signal did not get to the Speed Control Lever assembly Connector D11 (Pin 1).
E393	Suspect Wire 7000A between the Transmission to Front Console Harness Connector C1 (Pin 6) and the Speed Control Lever assembly Connector D11 (Pin 1) along with its terminals and connector contacts.	—	—	
E394	Measure the resistance between Pin 1 and 8 on the Speed Control Lever assembly Connector D11 (Speed Control Lever assembly side). Does it show short circuit (Lever in F or R)?	E396	E395	
E395	Suspect a detective Speed Control Lever assembly.	—	—	With the Speed Control Lever in F or R, Pin 1 and 8 should show short circuit.

STEP	QUESTION AND INSTRUCTION	GO TO STEP IF YES	GO TO STEP IF NO	COMMENTS
E461	With the Speed Control Lever Connector D11 disconnected, measure the resistance between Pin 5 and Pin 2 of the Speed Control Lever assembly. Verify the following: **SHIFT LEVER** — **RESISTANCE** N — Approx. 2.5K ohm REVERSE — Approx. 500 ohm. Do all measurements conform?	E463	E462	
E462	Defective Speed Control Lever assembly.	—	—	
E463	Measure the resistance between Pin 2 on the Speed Control Lever assembly and Earth. Does it show open circuit?	E464	E462	This circuit should be isolated from the chassis.
E464	Everything tests normal. No open circuits and no shorts. Inspect carefully the appropriate connector contacts on both the TCM Connector D3 and the Speed Control Lever assembly. If everything looks acceptable suspect a defective TCM.	—	—	If the problem appears to be intermittent, flex appropriate wires and disconnect and reconnect the TCM and Speed Control Lever assembly Connectors in order to locate the source of the problem.
E465	Disconnect the TCM Connector D3 and also the Speed Control Lever assembly Connector D11. Measure the resistance from Pin 7 of the TCM Connector D3 (Harness side) to Pin 9 of the Speed Control Lever assembly Connector D11 (Harness side). Does it show continuity?	E467	E466	This test looks for open circuits in the FORWARD line between the TCM and the Speed Control Lever assembly.

STEP	QUESTION AND INSTRUCTION	GO TO STEP IF YES	GO TO STEP IF NO	COMMENTS
S6	Suspect Wire 7290B and its terminals and also Splice F.	—	—	Splice F should have +12V present.
S7	Very unusual situation. All Solenoids energise properly except F1, F2, and R (none of which energise). +12V is present on the System Connector D6 for R and F1 (F2 gets its +12V directly from Splice F). Testing for +12V at Pin 1 of hyd. valve left hand 4 Pin Connector C10 (+12V for F1), Pin 3 of valve left hand 4 Pin Connector C10 (+12V for F2), and Pin 4 of valve right hand 4 Pin Connector C10 (+12V for R).	—	—	
S8	Is +12V present at terminal 1 of Directional Interrupt Relay Connector D7?	S14	S9	+12V should be present at terminal 1 if the Keystart is ON.
S9	Is +12V present at Pin 3 of the Limp Home Switch Connector D4?	S10	S11	The same +12V source supplies both terminal 1 of the Directional Interrupt Relay D7 as well as terminal 3 of the Limp Home Switch D4.
S10	Suspect Wire 7070E and its terminals.	—	—	+12V is present at the Limp Home Switch D4 but not at the Directional Interrupt Relay D7.
S11	Is the backlight on the Display Module D12 lit (shield from exterior light if in a well lighted environment)?	S12	S13	Check system power to Display Module D12. If there exists the possibility that the Display back–lighting bulb may be defective, is there +12V from Pin 4 (+) to Pin 1 (–) on the Display Module Connector D2 (Harness Side)?"
S12	Suspect Wire 7070E and also Splice A.	—	—	Display Module is getting +12V from Splice A but Wire 7070E isn't getting +12V to the Directional Interrupt Relay D7 or the Limp Home Switch D4.
S13	System Power Problem. Perform the System Power procedure as detailed in steps P1 – P27.	—	—	If +12V does not exist at terminal 4 of the Power Relay Connector B8, no system component is getting power.
S14	Is +12V present at terminal 3 of the Directional Interrupt Relay Connector D7?	S28	S15	Check if the Relay Coil is being powered. Reminder – Inching Pedal released, Keystart ON, and Speed Control Lever in F.

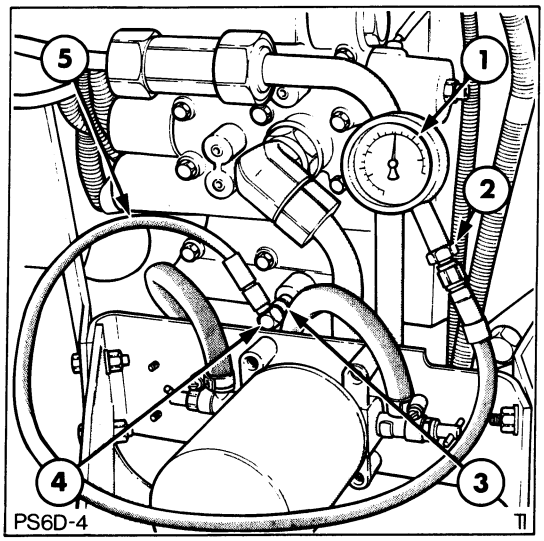


Figure 4
Pressure Testing the Main Control Valve Regulating Valve – Test Hook –up

1. Pressure Gauge FT 8616 or FNH 06653
2. Adaptor Tool No. FT 8503–8 or FNH 00705
3. Adaptor FT 8613 or FNH 00109
4. Elbow 86246–S36
5. Test Hose E1NN F493 AA or FNH 07089

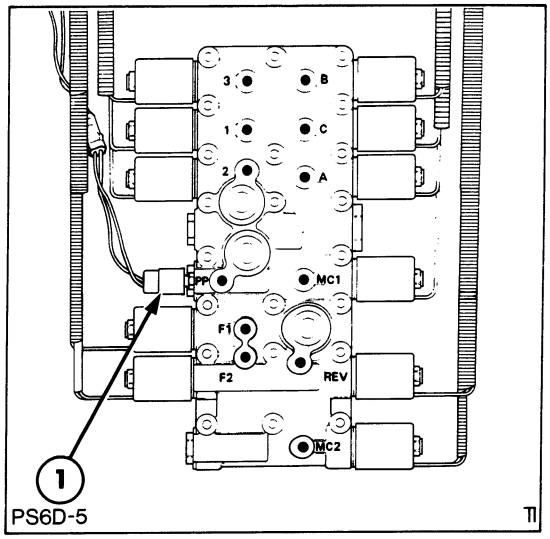


Figure 5
Pressure Test Ports (identified in black)

1. Pressure Sender Switch

7. Record the oil flow being delivered from the control valve.

If this second flow test result shows that the specified flow is being delivered from the control valve then there must be a restriction in the cooler, its supply hose or in the return hose.

Remove the cooler supply and return lines following established techniques and either establish the reason for blockage or restriction or replace the suspect item.

Pressure Testing the Regulator Valve

The pressure regulating valve maintains a constant pressure in the control valve for the application of each of the speed and directional clutches. Its pressure setting is important to the basic function of the transmission. too high a pressure could result in unnecessary loadings on the clutch pistons and seals, whilst too low a pressure could cause clutch slip and premature transmission failure.

To test the regulator valve, proceed as follows with reference to Figure 4.

1. Position the tractor on a hard level surface and apply the parking brake. Place the speed control lever in neutral.

2. Connect the pressure test gauge (0–400 lbf/in^2, 0–27 bar) Tool No. FT 8616 or FNH 06653, into the MC2 pressure test port using adaptors No. FT 8613 or FNH 00109, a $^7/_{16}$ in. JIC male/female elbow (Ford Part No. 86246–S36 finis 3926127 or equivalent proprietary item), a hose (Ford Part No. EINN F493 AA finis 3936707) or FNH 07089 and adaptor Tool No. FT 8503–8 or FNH 00705.

NOTE: *Where a $^7/_{16}$ JIC male/female elbow is not readily available, the pressure gauge adaptor FT 8613 or FNH 00109 can be installed in the pressure regulator valve test port, however access to this port is slightly restricted by the pipework to the control valve.*

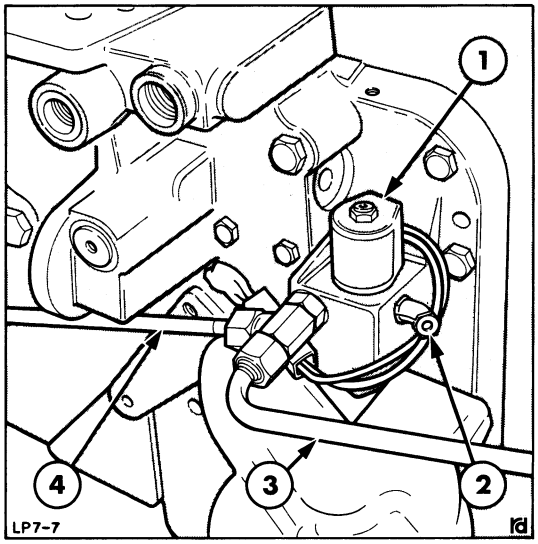


Figure 7
Pressure Testing Port Location

1. Differential Lock Solenoid
2. Test Port
3. Pressure Line to Differential Lock, P.T.O. and Front Wheel Drive Engagement Solenoid
4. Pressure Line to Front Wheel Drive Engagement Solenoid

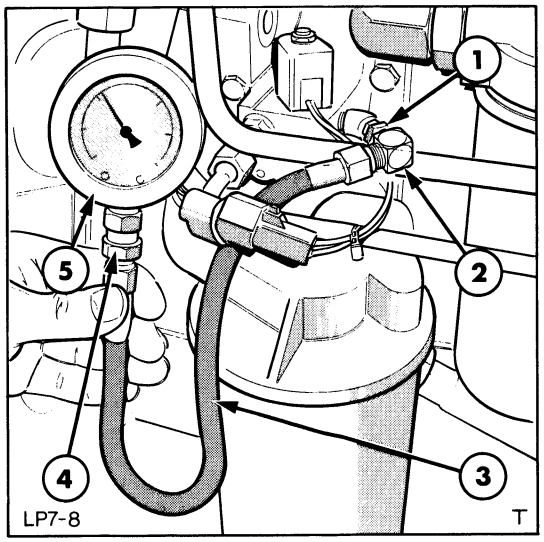


Figure 8
Pressure Testing Low Pressure Hydraulic System

1. Adaptor FT 8613 or FNH 00109
2. Elbow 86246–S36
3. Test Hose E1NN F493 AA or FNH 07089
4. Adaptor FT 8503–8 or FNH 00705
5. Pressure Gauge FT 8616 or FNH 06653

C. PRESSURE TESTING

The following procedure tests the low pressure hydraulic system for operation of the dual power, P.T.O., differential lock and four wheel drive systems. For hydraulic testing of the powershift transmission refer to Part 5 Chapter 6 of this Repair Manual.

The following test procedure can be used to isolate a particular problem within the system. For example, if a pressure reading is low in only one step of the test, the cause of the hydraulic concern is related to the part of the system with the low reading. If pressure readings are low in all tests the regulating valve or pump is probably at fault.

Perform the pressure test as follows and compare the readings obtained with those listed in Specifications Section D of this Chapter.

1. Operate the tractor until the hydraulic system oil is at normal operating temperature. Stop the engine.
2. Remove the plug from the upper test port adjacent to the differential lock solenoid , Figure 7.
3. Using adaptor FT 8613, a $^{7}/_{16}$ in JIC male/female elbow (Ford Part No 86246–S36 Finis code 3926127 or equivalent proprietary item), hose (Ford Part No E1NN F493 AA Finis code 3936707) and adapter FT8503–8 connect the low pressure test gauge FT8616 into the system, Figure 8.
4. Start the engine and set the speed at 1000 rev/min. Engage the four wheel drive (where fitted).
5. Tractors with Dual Power (16x4 Transmissions)
   (a) Check the pressure with the Dual Power in underdrive (tortoise symbol illuminated)
   (b) Check the pressure with the Dual Power in direct drive (hare symbol illuminated)

PART 6
POWER TAKE-OFF

Chapter 1
SERVICING THE INDEPENDENT POWER TAKE-OFF

Chapter 2
TROUBLE SHOOTING, SPECIFICATIONS AND SPECIAL TOOLS

D. I.P.T.O. CONTROL VALVE — OVERHAUL

REMOVAL

Remove the I.P.T.O. clutch and control valve assembly as detailed on Page 8.

DISASSEMBLY

With reference to Figure 13.

1. Working on a bench, withdraw the control valve spool, pressure regulating valve rod and spring from the valve body.

2. Remove the circlip and extract the regulating valve guide, spring and regulating valve. If the valve guide is tight in the bore, rap the valve body on a wooden surface to free the guide.

NOTE: *The regulating valve is only serviced as an assembly.*

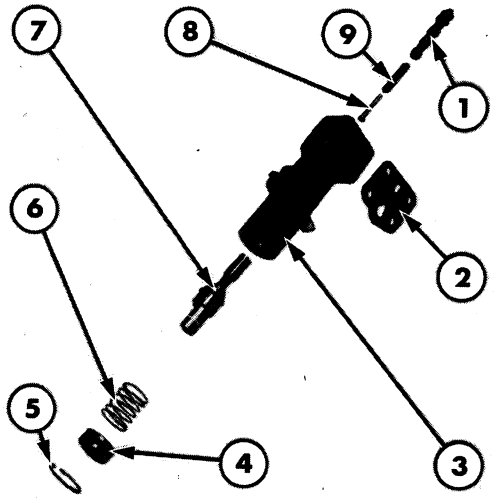


Figure 13
I.P.T.O. Control Valve Assembly
1. Control Valve Spool
2. Gasket
3. Valve Body
4. Regulating Valve Guide
5. Retaining Spring
6. Spring
7. Regulating Valve Assembly
8. Regulating Valve Rod
9. Valve Rod Spring

INSPECTION AND REPAIR

1. Clean all parts in a suitable solvent and dry thoroughly with a clean, lint-free cloth or compressed air.

2. Inspect the control valve spool and housing for wear, burrs or scoring. Minor burrs or scratches may be removed with a fine abrasive material but parts must be washed and dried prior to re-assembly.

3. Examine the regulating valve, guide, rod and springs for wear or damage.

   If damage or serious wear is evident on any component, install a replacement on re-assembly.

RE-ASSEMBLY

Re-assembly of the I.P.T.O. control valve follows the disassembly procedure in reverse. On re-assembly observe the following requirement:

- Replace the gasket and install the four socket head screws to secure the valve to the I.P.T.O. support assembly. Tighten the screws to the correct torque, see Page 5, 'Specifications' — Chapter 2.

PART 7
REAR AXLE AND BRAKES

Chapter 1
SERVICING THE REAR AXLE ASSEMBLY AND BRAKES

Chapter 2
TROUBLE SHOOTING, PRESSURE TESTS, SPECIFICATIONS AND SPECIAL TOOLS

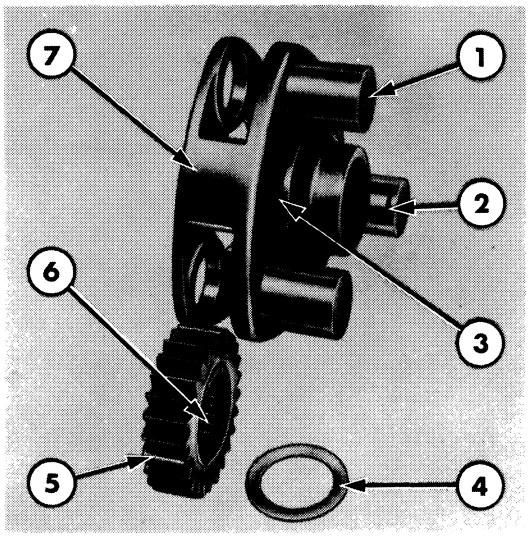


Figure 18
Planetary Carrier Disassembled

1. Planet Gear Pin
2. Retainer Groove
3. Retainer
4. Thrust Washer
5. Planet Gear
6. Needle Bearings (54)
7. Carrier

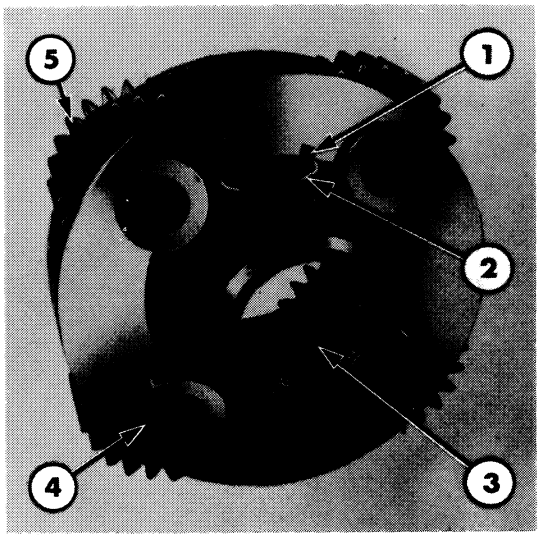


Figure 19
Planetary Carrier (TW-35)

1. Retainer
2. Lock Wire
3. Splined Hub
4. Planet Gear Pin
5. Planetary Gear

3. Remove the 54 needle bearings and spacer from each gear.

   NOTE: *The 4-pinion planetary assembly for the TW-35 model is disassembled in a similar manner, Figure 19.*

INSPECTION AND REPAIR

1. Clean and inspect the gears, pins, needle bearings, thrust washers, spacers and carrier.

2. If damage or abnormal wear is evident, install a new part on re-assembly.

RE-ASSEMBLY

1. Use grease to position the 54 needle bearings and spacer in each gear.

2. Install each gear and thrust washer in the carrier and position the pins with the grooves towards the retainer, Figure 18.

3. Seat the retainer in the groove in each pin.

4. Install a new wire behind the retainer and wrap the ends of the wire around the ends of the retainer to lock in position, Figure 17.

INSTALLATION

1. Align the planet gear teeth with the ring gear teeth and the splines of the axle shaft with the internal splines of the planetary carrier then install the planetary carrier assembly in the housing, Figure 9.

2. Install the retaining washer, spacer and bolt. Tighten the bolt to the correct torque, see Page 6, 'Specifications' — Chapter 2. Position the lock over the bolt head. Ensure the lock plate does not fall out of position during assembly of axle to centre housing.

3. Install the axle housing as detailed in Section A of this Chapter.

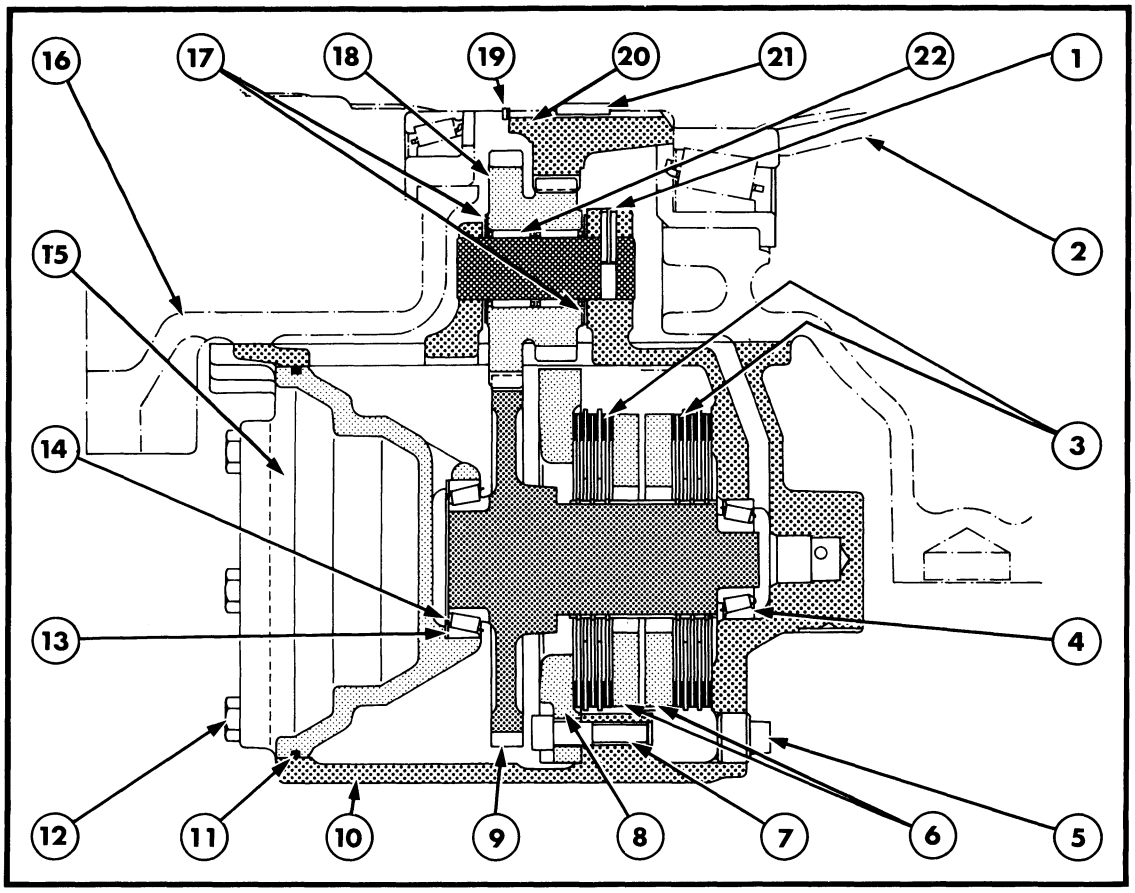


Figure 44
Transmission Handbrake Assembly

1. Roll Pin
2. Main Drive Pinion
3. Brake Plates
4. Handbrake Shaft Rear Bearing
5. Magnetic Drain Plug
6. Actuator Assembly
7. Screw
8. Brake Retaining Disc
9. Handbrake Driven Gear and Shaft Assembly
10. Handbrake Housing
11. Seal
12. Cap Bolt
13. Shim Washer
14. Handbrake Shaft Front Bearing
15. Brake Housing Cap
16. Rear Axle Centre Housing
17. Spacers
18. Double Intermediate Gear
19. Retaining Ring
20. Handbrake Drive Gear
21. Key
22. Bearing Assembly

2. Lift out the intermediate gear together with the two plastic spacers and slide out the two needle bearing assemblies located in the gear.

3. Stand the brake assembly upright on the rear end.

4. Withdraw the bolts and carefully pull the brake housing cap free from the handbrake housing.

5. Carefully pull the handbrake driven gear and shaft assembly free from the housing.

B. PRESSURE TESTS

If the differential lock or power brakes fail to operate correctly, the low pressure hydraulic system pressure tests should be conducted as detailed in Chapter 3 of "TRANSMISSION SYSTEMS" — Part 5.

The pressure tests should alse be conducted after the differential lock or power brakes have been overhauled.

C. SPECIFICATIONS

REAR AXLE SPECIFICATIONS

Axle Type	Double reduction inboard planetary
Axle Clearance	16.4 in (41.6 cm)
Axle Ratio	28.239:1
Wheel Tread Ranges:	
Manual Adjust:	
84 Inch Axle	60—90 in (152—229 cm)
105 Inch Axle	60—110 in (152—280 cm)
Power Adjust:	
84 Inch Axle	60—90 in (152—229 cm)
105 Inch Axle	60—116 in (152—295 cm)
Differential Ring Gear:	
Number of Teeth	
TW-5, TW-15 and TW-25	40
TW-35	45
Drive Pinion:	
Number of Teeth	
TW-5, TW-15 and TW-25	7
TW-35	8
Pinion Bearing Preload	10—20 lbf (44—88 N) (4.5—9 Kg)
Pinion Backlash	0.01—0.02 in (0.25—0.51 mm)
Differential:	
Bearing Preload	0.006—0.001 in (0.152—0.025 mm)
Axle Shafts:	
Diameter	
TW-5, TW-15 and TW-25	3.38 in (85.9 mm)
TW-35	3.62 in (91.9 mm)
End Play	0.003—0.009 in (0.076—0.228 mm) Tight

PRESSURE SETTINGS

Differential Lock System Pressure Power Brake System	185—220 lbf/in² (12.8—15.2 bar) (13—15.5 Kgf/cm²)

With tractor engine speed at 2200 rev/min system pressure should be 185—235 lbf/in² (12.8—16.2 bar) (13—16.5 Kgf/cm²)

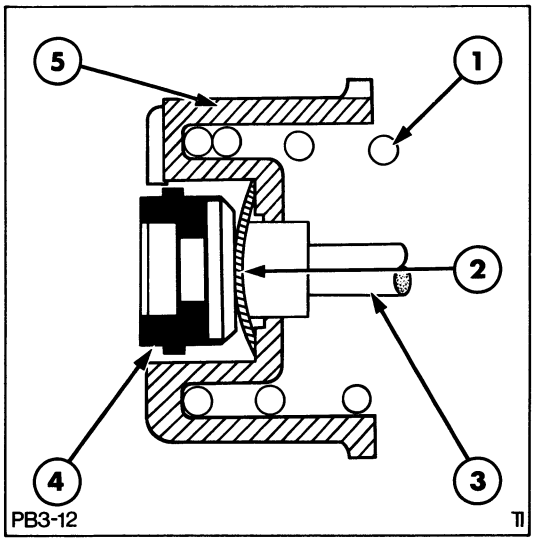


Figure 12
Valve Stem Seal Assembly

1. Spring
2. Curved Washer
3. Valve Stem
4. Valve Seal
5. Valve Spacer

3. If the old seals appeared to be loose when they were removed compare them with their new equivalent seals. **DO NOT LET THEM TOUCH.** If the old seals appear appreciably larger than the new ones then contamination is indicated and the whole transmission assembly should be flushed out and refilled with new oil to the correct specification as detailed in the Operators Manual.

4. Thoroughly clean all parts with the specified transmission oil before re–assembly.

RE–ASSEMBLY

Use the new parts in the service kit when re–assembling. Lubricate the inner diameters of the seals with clean transmission oil to the correct Specification before fitting.

Master Cylinder

1. Fit new seals to the plunger and valve stem.

2. Position the curved washer on the valve stem so that it "flares" away from the valve stem shoulder as illustrated in Figure 12.

3. Position the valve spacer on the valve stem and locate the return spring inside the spacer.

4. Fit the spring retainer to the end of the spring and compress the spring until the valve stem passes through the keyhole in the retainer and engages in the centre.

5. Fit the spring sub–assembly to the plunger and press home until the leaf of the retainer engages on the retaining groove on the plunger.

6. Liberally lubricate the plunger assembly and cylinder bore with new transmission oil as Specified in the Operators Manual. Insert the plunger assembly into the master cylinder bore taking care not to damage the seal on the plunger.

7. Place the master cylinder in a safe place until you are ready to fit it to the booster.

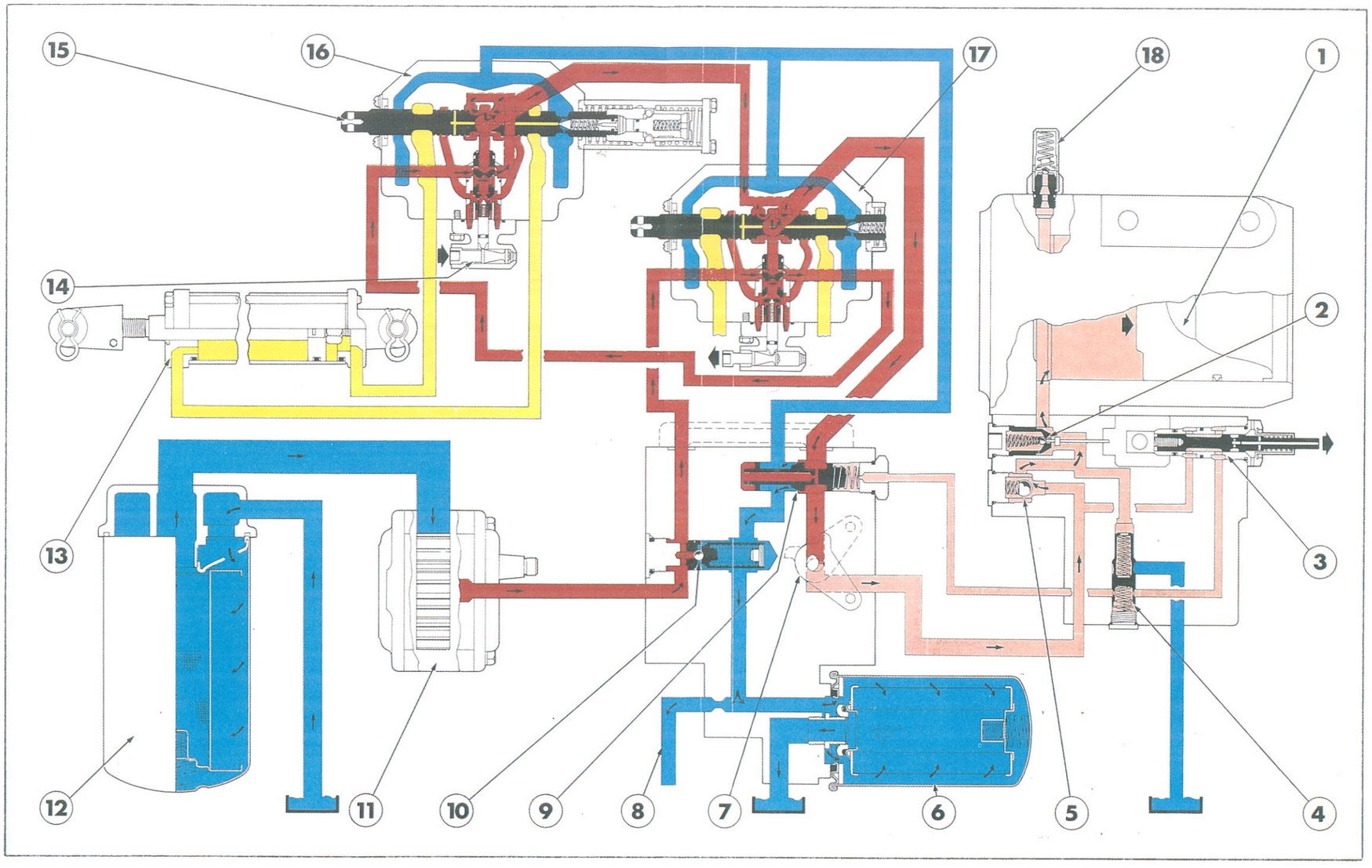


Figure 2

Hydraulic System Oil Flow — Raising

Supply Pressure Oil

Reduced Pressure and Pilot Pressure Oil

Reservoir Suction and Exhaust Oil

Trapped Oil

1. Lift Piston
2. Drop Valve
3. Control Valve
4. Exhaust Valve
5. Check Valve
6. Return Filter
7. Variable Flow Valve
8. Return to Sump
9. Flow Control Valve
10. System Relief Valve
11. Hydraulic Pump
12. Intake Filter
13. Remote Cylinder
14. Flow Valve in Minimum Flow Setting
15. Remote Control Valve Spool
16. Remote Control Valve
17. Remote Control Valve
18. Lift Cylinder Safety Valve

PART 8
HYDRAULIC SYSTEM

Chapter 2
HYDRAULIC POWER LIFT
TRACTORS PRIOR TO APRIL 1985

A. HYDRAULIC POWER LIFT — DESCRIPTION AND OPERATION

The hydraulic power lift is regulated both in Draft and Position Control by movement of the control valve. Depending upon the position of this valve, hydraulic oil is directed to effect a raise, lower or neutral action.

The position of the control valve can be altered either by moving the lift control lever or by a force acting on the lower links when in Draft Control.

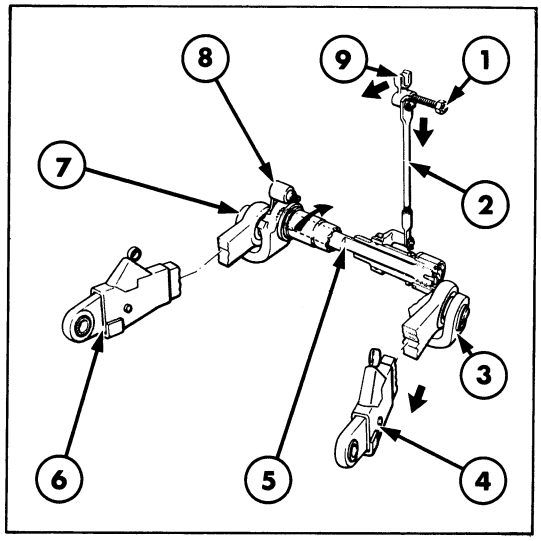


Figure 1
Lower Link Torsion Bar Reaction

1. Adjusting Screw
2. Draft Rod
3. Right Hand Lower Link Hanger
4. Right Hand Lower Link
5. Torsion Bar
6. Left Hand Lower Link
7. Left Hand Lower Link Hanger
8. Anchor
9. Draft Control Lever

DRAFT CONTROL

The system of Draft Control uses the lower link signal to raise or lower the implement working depth to maintain a constant draft. When the system selector lever is pushed fully forward in the control console, the Draft Control system functions as follows:

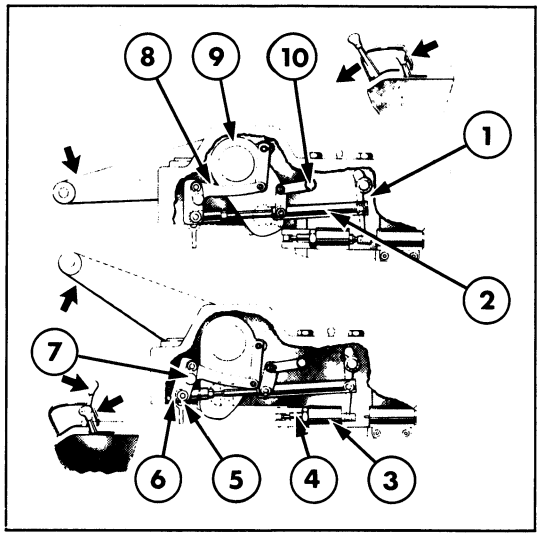


Figure 2
Draft/Position Control Linkage — Draft Control

1. Control Valve Lever
2. Connecting Rod
3. Control Valve
4. Pivot Arm
5. Draft Control Lever
6. Draft/Position Control Guide
7. Pivot Point
8. Position Control Arm
9. Ram Arm
10. Selector Shaft

REMOVAL AND DISASSEMBLY

With reference to Figure 13.

1. Drain the oil from the rear axle centre housing. Be prepared to drain approximately 17 Imp. gallons (20 U.S. gallons) (76 litres).

2. Remove the hydraulic lift cover as detailed on Page 1.

3. Remove the lower links from the left-hand and right-hand lift link hangers, Figure 13.

4. Remove both retaining rings.

5. Withdraw the hexagon headed bolt, lockwasher and flat washer then remove the right-hand lift link hanger from the end of the left-hand lift link hanger. Remove the thrust washer spacer and O-ring seal.

6. Remove the hexagon headed bolts and lock washers from the torsion bar anchor. Pull the anchor, along with the lift link torsion bar, from the hanger.

NOTE: *If the torsion bar does not come out with the anchor, drive the shaft from the hanger with a hammer and brass drift. Drive the bar from right to left.*

7. Loosen the hexagon nut. Extract the split pin and washer from the eccentric shaft then remove the shaft from the centre housing.

8. Loosen the jam nut and remove the set screw, Figure 14.

9. Slide the draft control arm from the shoulder of the hanger.

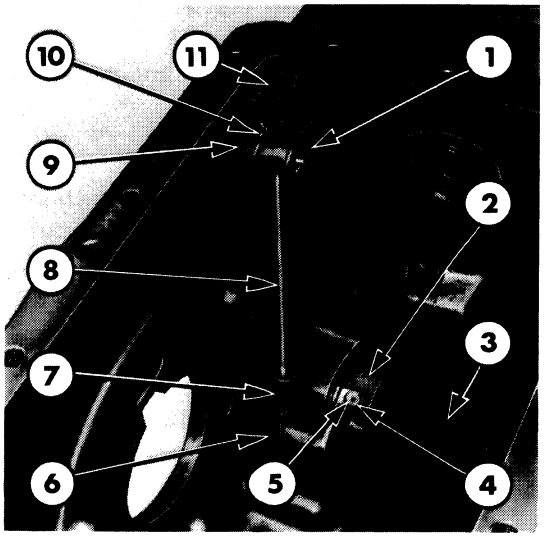


Figure 14
Draft Control Arm Linkage

1. Split Pin and Washer
2. Draft Control Arm
3. Left-hand Hanger
4. Jam Nut
5. Set Screw
6. Split Pin and Washer
7. Draft Rod End
8. Draft Rod
9. Eccentric Shaft
10. Split Pin and Washer
11. Draft Control Lever

10. Extract the split pin and washer then disconnect and remove the draft rod end from the control arm.

11. Extract the split pin and washer then separate the draft rod from the draft control lever.

12. Pull the hanger from the centre housing to a point where access can be gained to the woodruff key. Remove the control arm and the woodruff key then pull the hanger from the centre housing.

13. Remove the O-ring seal and thrust washer from the hanger.

14. Withdraw the hexagon headed bolt and lock washer then remove the hanger stop from the left-hand side of the centre housing.

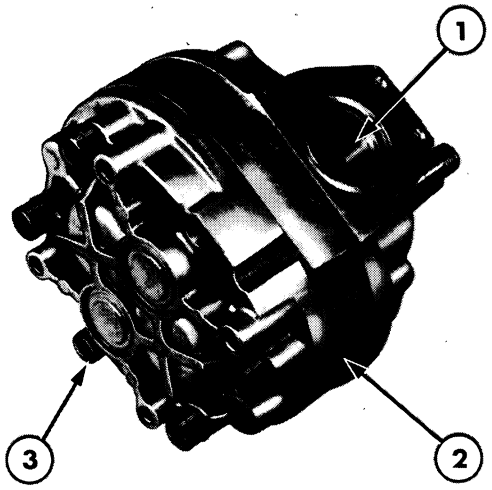


Figure 31
Hydraulic Pump—TW-35 Tractors
1. Intake Port
2. Pump Body
3. Shortest Cap Screw is installed in this position

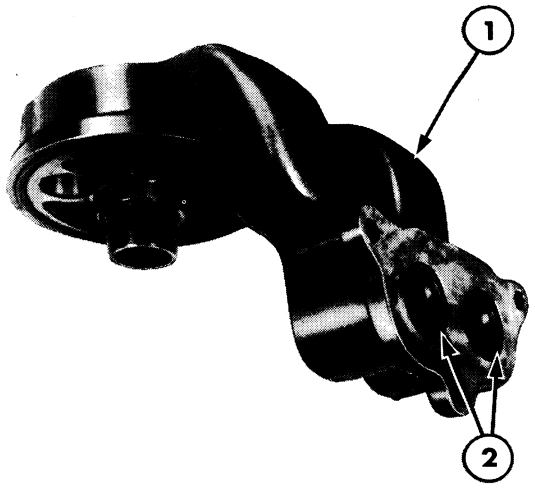


Figure 32
Inlet Filter Manifold
1. Manifold
2. Tube Seals

4. Install the drive gear and driven gear in the front cover. Carefully install the pump body over the gears making sure that the dowels enter the dowel holes in the cover. Note that the body is correctly positioned when the intake manifold bolt holes in the body are as close as possible to the intake port in the front cover as shown in Figure 31.

5. Secure the components with the five socket head cap screws and washers. Note that one of the cap screws is shorter than the others and must be installed in the position as shown in Figure 31. Tighten the cap screws to the correct torque, see Page 12, 'Specifications' — Chapter 4.

6. Install the woodruff key, the drive gear and retaining nut. Tighten the retaining nut to the correct torque, see Page 12, 'Specifications' — Chapter 4. Secure the nut with a new split pin.

7. Use the four bolts to attach the pump inlet manifold to the hydraulic pump. Ensure new O-ring seals are installed between the pump and the manifold and within the inside diameter of the manifold at the inlet filter end. Tighten the attaching bolts to the correct torque, see Page 12, 'Specifications' — Chapter 4.

INSTALLATION

Install the hydraulic pump as detailed on Page 21.

INLET FILTER MANIFOLD

REMOVAL AND INSTALLATION

With reference to Figure 32.

1. Drain the oil from the rear axle centre housing. Be prepared to drain approximately 17 Imp. gallons (20 U.S. gallons) (76 litres).

Draft Control Lower Linkage Stop Adjustment

An adjustable eccentric stop is attached to the left-hand side of the centre housing behind the left-hand lift link hanger to limit rearward movement of the hanger and twist of the torsion bar, Figure 51. Forward movement of the hanger is limited by the fixed torsion bar anchor.

Adjust the stop as follows:

1. Loosen the hexagon headed attaching bolt and rotate the stop until the gap between the stop and the hanger is 0.33—0.34 in (8.4—8.6 mm).

2. Hold the stop in position and tighten the attaching bolt to the correct torque, see Page 12, 'Specifications' — Chapter 4.

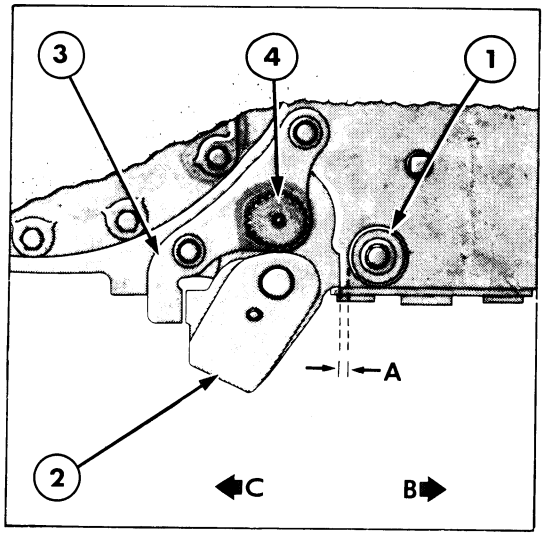


Figure 51
Draft Control Lower Linkage Stop Adjustment
A. 0.33—0.34 in (8.4—8.5 mm) gap
B. Rear
C. Front
1. Eccentric Stop
2. Left-hand Link Hanger
3. Torsion Bar Anchor
4. Torsion Bar

REAR AXLE AND HYDRAULIC OIL

OIL CAPACITY

	Imp. Galls	*U.S. Galls*	*Litres*
Ford TW-5, TW-15 and TW-25 Less Dual Power	13.3	16	61
Ford TW-5, TW-15 and TW-25 With Dual Power	14.2	17.5	66
Ford TW-35	16.7	20	76

LUBRICANT

Fill with the correct grade, quantity and type of oil as specified in the relevant Ford Tractor Operators Manual.

D. SPECIAL TOOLS

(Prior Tool Numbers, where applicable, shown in brackets)

DESCRIPTION	V. L. CHURCHILL TOOL NO.	NUDAY TOOL NO.
Lifting Fixture (Hydraulic Lift Cover)	FT.8610	1302 (SW-522)
Step Plate Adaptors	630S	9210 (630S)
Break-Away Coupling Male Tip	—	2362 (D-8F)
Hose and Fitting Assembly	FT.4100-1	2106 (D-19-HP)
Adaptor	N.1100C	0035 (D-11)
Pressure Gauge	FT.8503A (T.8503A)	2028 (D-22)
Tee Fitting	—	0027 (ND-135-4.1)
Hose Assembly	FT.8503-4 (T.8503-4)	1392 (N-1100-J)
Load Valve	FT.8503-1B (T.8503-1B)	1394 (N-1100-N)
Pipe Nipple	—	No Number
Low Pressure Hose	—	No Number

Each De-Luxe Remote Control Valve has a flow control restrictor to enable the output of every spool to be individually adjusted to suit particular operations. The restrictor is mounted at the rear of the valve body and is turned by means of an easily accessible flow control knob which is graduated for reference, and to enable frequently used settings to be repeated. When operating any spool at a slow flow setting any excess output from the hydraulic pump(s) is returned to sump by the priority valve pack.

A centring spring, located at the rear of the control valve spool holds the spool in the neutral position until displaced by movement of the control lever via the linkage. The control valve, and therefore control lever, has four positions to give raise, neutral, lower and float.

A detent mechanism, also located at the rear of the spool, holds the control valve spool in the raise or lower position until released by the increase in pressure when the remote cylinder reaches the end of its stroke.

The pressure required in the external hydraulic systems to return the control valve to neutral is easily adjusted by means of the detent regulating valve which is located on the exterior of the valve block in the housing containing the control valve centring spring.

Screwing the detent regulating valve in will increase the pressure required in the external circuit to release the detent mechanism and allow the centring spring to return the control spool to neutral.

Screwing the detent regulating valve out will allow the control valve spool to return to neutral at a lower pressure in the external circuit.

Refer to 'Pressure Testing Detent Regulating Valve' – Chapter 8.

The detent regulating valve may also be screwed out so that the remote system pressure will be sufficient to permanently release the detent mechanism. In this way the operation of the De-Luxe Remote Control Valve will be "non-detented" and the control spool will return to neutral when the control lever is released. "Non-detented" operation provides easier control for applications requiring small incremental adjustment of external hydraulic cylinder travel.

The detent mechanism, if required, will also hold the control spool in float. However when operating in the float position both sides of the external hydraulic cylinder are connected to the return circuit therefore pressure cannot be generated to operate the detent regulating valve and overcome the detent mechnanism. The control valve spool will remain in float until the control lever is manually returned to neutral.

The De-Luxe Remote Control Valves may be used to operate double-acting or single-acting equipment. For single-acting operations the single external hose is connected to the lift port of the quick release coupling. The single-acting cylinder is extended by moving the control lever to raise, and retracted by moving the control lever directly to the float position.

IMPORTANT: *Always use the float position to lower a single-acting cylinder.*

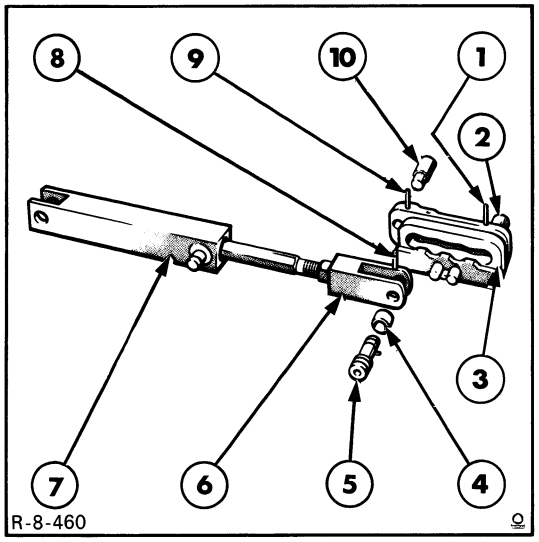


Figure 9
Connecting Rod Actuator Assembly

1. Roll Pin
2. Pivot Pin
3. Draft and Position Control Guide
4. Roller
5. Clevis Pin
6. Clevis
7. Actuator
8. Roll Pin
9. Roll Pin
10. Pin and Roller

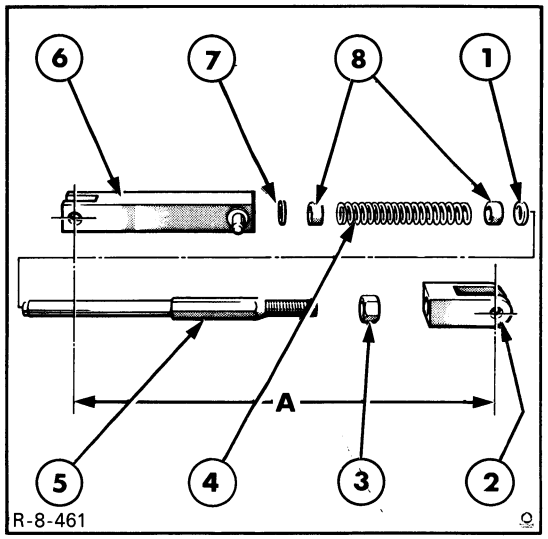


Figure 10
Connecting Rod Actuator – Exploded View

A. 13.77-13.80 in (349.6-350.4 mm)
1. Internal Retainer Ring
2. Clevis
3. Hexagon Nut
4. Spring
5. Rod
6. Actuator
7. Retainer Ring
8. Bearings

5. Remove all old gasket material from the surface of the lift cover. Check the surface for nicks and burrs. Use a stone, as required, to remove imperfections.

6. Check the pin and roller, pivot pin, roller, clevis pin and control guide for wear, Figure 9. If the parts are worn, drive out the roll pins to separate the assembly.

7. Remove the retaining rings and disassemble the actuator, Figure 10. Check the spring and bearing for damage or wear. Where necessary, install new parts.

8. Assemble the actuator assembly and adjust the clevis to obtain a dimension of 13.77 to 13.80 in (349.6 to 350.4 mm) between the pivot points on the end of the actuator and the clevis. Lock the clevis in place with the hexagonal nut and securely tighten.

9. Inspect the 'O' ring seals on the oil pressure connecting sleeve and the pilot sleeve, Figure 5. Replace, if necessary.

10. Inspect the 'O' ring seal on the position control selector shaft, Figure 7. Replace, if necessary.

5. Inspect the friction washer and the steel spring washer for damage or wear. The purpose of the friction and spring washers is to keep tension on the lever. If the washers are worn excessively, the lever will be loose and will not hold the setting that the operator selects with the flow control knob resulting in unsatisfactory operation.

NOTE: *If any parts of the system relief valve are replaced, other than seals, the valve must be pressure tested as outlined in Chapter 8.*

6. Replace all 'O' ring seals with new parts on re-assembly.

RE-ASSEMBLY

1. Install the system pressure sleeve.

2. Assemble the system relief valve and install in the hydraulic pump cover assembly.

3. TW-5, TW-15 and TW-25 Tractors:

   (a) Place the return spring in the differential lock bore of the hydraulic pump cover assembly. Install the differential lock control valve over the return spring.

   (b) Insert the actuating rod through the cap and 'O' ring. Screw the assembly into the pump cover assembly. Tighten the cap securely.

4. Ensure the back-up rings on the variable flow control restrictor are installed on the outboard side of the 'O' ring seal. Insert the valve, long end first, into the hydraulic pump cover assembly so the slot in the valve is pointing towards the top of the cover.

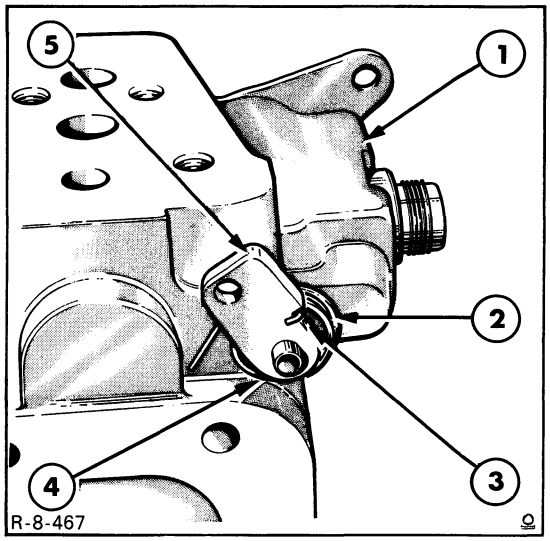


Figure 21
Variable Flow Control Restrictor Override Spring Installation

1. Hydraulic Pump Cover
2. Override Spring
3. Roll Pin
4. Variable Flow Restrictor End
5. Arm

5. Place the friction washer on the pump cover as shown in Figure 18. Hold in place with a small amount of grease. Place the spring washer and lever over the gland and 'O' ring seal assembly then screw the gland into the pump cover. Tighten the gland to the correct torque, see "Specifications" – Chapter 8.

NOTE: *The cupped side of the spring washer faces toward the lever when correctly assembled.*

6. Place the shim(s) and arm over the shaft and secure with the roll pin.

7. Place the variable restrictor override spring and arm over the end of the valve spool and secure with the roll pin as shown in Figure 21. Ensure the spring has approximately one turn of wind-up tension.

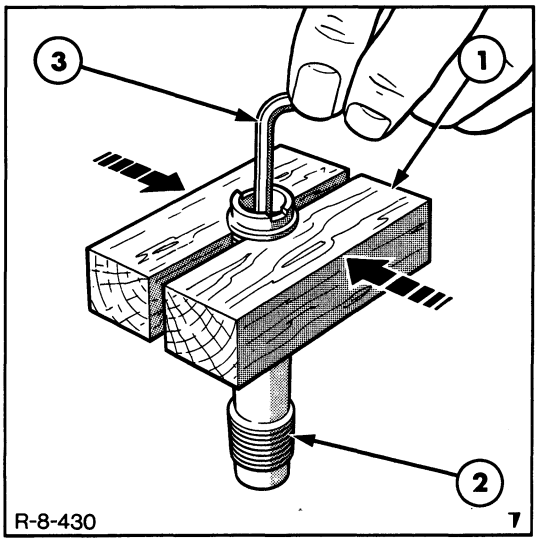


Figure 44
Relief Valve Removal

1. Wooden Blocks
2. Unload Valve Spool
3. Hexagon Key Wrench

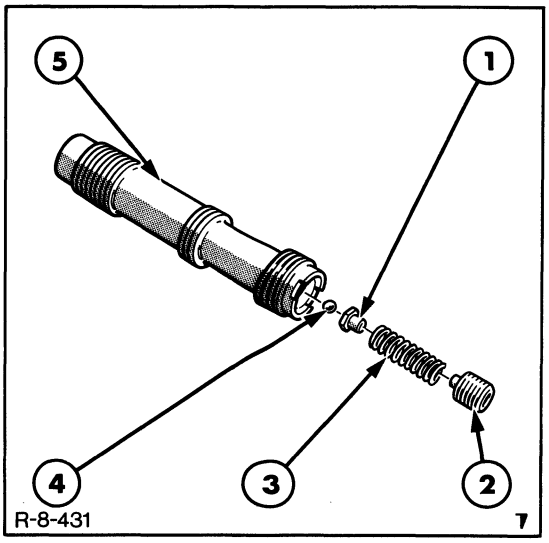


Figure 45
Relief Valve Components

1. Ball Retainer
2. Adjuster Plug
3. Spring
4. Ball
5. Unload Valve Spool

(a) Bore a 22.0 mm dia hole in a suitable piece of softwood, then saw the wood in half across the diameter of the hole. Gently but firmly clamp the spool around the top land using the wood between the jaws of a vice, Figure 44.

(b) Place a hexagon key wrench in the hexagon socket of the adjuster plug. Carefully count and record the number of anti-clockwise revolutions made before the adjuster plug is free, then remove the spring, ball retainer and ball, Figure 45.

(c) Carefully examine the conical seat of the ball retainer, the ball, and the ball seat within the spool, for wear, damage or contamination. Measure the free length of the spring which should be 1.0 in (25.4 mm).

If any of the relief valve components are not in a first class condition, the complete spool assembly should be renewed. The new spool will have the integral relief valve correctly set.

(d) If all components are found to be in excellent condition, the unload spool can be re-assembled. To maintain the original pressure setting of the relief valve, the adjuster plug should be screwed in by the exact number of turns required for removal.

INSPECTION AND REPAIR

1. Wash all the priority valve components in a suitable solvent and dry with a lint free cloth or compressed air.

2. Examine the valve spools and sleeves for wear, burrs or scratches. Minor imperfections may be removed with a fine abrasive; ensure such parts are thoroughly washed before re-assembly. Heavy scoring of the valve spools or sleeves will necessitate renewal of the matched spool/sleeve assembly.

3. Measure the dimension between the centres of the dowel hole and draft control lever (centre of fork). The correct dimension is 5.62 in (142.7 mm).

   If the dimension is too short or too long:

   - Dimension too long – Lengthen rod as follows:
   - Dimension too short – Shorten rod as follows:

4. Remove the split pin and washer from the eccentric.

5. Move out the eccentric and rotate the rod as required in the draft rod end.

6. Install the eccentric and re-check the measurement. Ensure the eccentric is in the straight 'up' position.

7. Repeat Steps 5 and 6 as required until the correct dimension is obtained.

8. Install the washer and split pin. Lock the eccentric in the 'up' position by tightening the draft control adjustment lock nut to the correct torque, see "Specifications" – Chapter 8.

Position Control Adjustment

Before making the position control adjustment, ensure that all preceding internal and external adjustments have been made, otherwise a false setting will result.

1. Place the hydraulic selector lever in position control (fully rearward).

2. Position the hydraulic lift control lever edge 0.5 – 1.0 in (13 – 25 mm) away from the front edge of the slot in the console (lower position).

3. Loosen the locknut on the position control adjustment, Figure 70. Turn the adjustment until the punch mark is positioned at '3 o'clock.' This provides a starting point for the adjustment.

4. Start the engine and set the speed to 700 – 800 rev/min (idle).

5. Turn the position control adjustment clockwise until the lower links begin to raise, then while holding the adjustment, tighten the lock nut to the correct torque, see "Specifications" – Chapter 8.

Draft Control Adjustment

Before making the draft control adjustment, make sure that all preceding internal and external adjustments have been made, otherwise a false setting will result.

1. Place the hydraulic selector lever in draft control (fully forward).

2. Position the hydraulic lift control lever edge 0.5 – 1.0 in (13 – 25 mm) away from the rear edge of the slot in the console (raise position).

3. Loosen the locknut on the draft control adjustment, Figure 70. Turn the adjustment until the punch mark is positioned at '6 o'clock'. This provides a starting point for the adjustment.

4. Start the engine and set its speed to 700 – 800 rev/min (idle).

5. Turn the draft control adjustment clockwise until the lower links begin to raise, then while holding the adjustment, tighten the locknut to the correct torque, see "Specifications" – Chapter 8.

REAR AXLE AND HYDRAULIC OIL

OIL CAPACITY

	Imp. Galls	*U.S. Galls*	*Litres*
Ford TW-5, TW-15 and TW-25 Less Dual Power	15.2	18.2	69.1
Ford TW-5, TW-15 and TW-25 With Dual Power	16.5	19.8	74.8
Ford TW-35	19.1	22.9	87.0

With front wheel drive increase the oil fill by 1.2 Imp. Galls, 5.2 Litres, 1.4 U.S. Galls.

LUBRICANT

Fill with the correct grade, quantity and type of oil as specified in the relevant Ford Tractor Operators Manual.

TORQUE SPECIFICATIONS

	lbf.ft	Nm	Mkg
Attaching Bolt in End of Torsion Bar	22	30	3.1
Draft Control Adjustment Lock Nut	130	176	18.0
Draft Control Arm Set Screw Jam Nut	22	30	3.1
Draft Control Lower Linkage Stop Attaching Bolt	55	75	7.6
Exhaust Valve Plug	65	88	9.0
Flow Control Actuator Housing Attaching Bolt	12	16	1.7
Flow Control and Unload Valve Sleeves	75	102	10.4
Hydraulic Lift Cover Attaching Bolts	155	210	21.5
Hydraulic Pump Attaching Bolts	22	30	3.1
Hydraulic Pump Cover Attaching Bolts	35	47	4.9
Hydraulic Pump Drive Gear Retaining Nut	48	65	6.7
Hydraulic Pump Front Cover Attaching Bolts (TW-5, TW-15 and TW-25)	67	91	9.3
Hydraulic Pump Rear Cover Attaching Bolts (TW-5, TW-15 and TW-25)	67	91	9.3
Hydraulic Pump Body Bolts	35	47	4.9
Inlet Filter Manifold Attaching Bolts	25	34	3.5
Lift Actuating Lever Attaching Nut	80	108	11.1
Lift Arm Attaching Bolts	75	102	10.4
Lift Control Rod Turnbuckle Locknut	25	34	3.5
Lift Control Valve Attaching Bolts	22	30	3.1

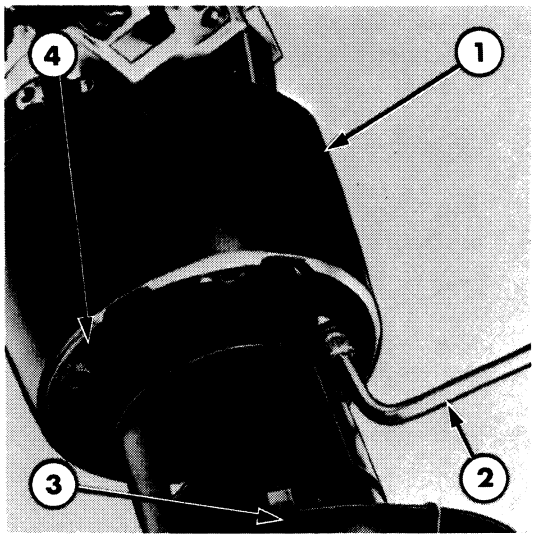


Figure 8
Flange (Tilt Mechanism)
1. Upper Extension
2. Allen Key
3. Lower Extension
4. Retainer

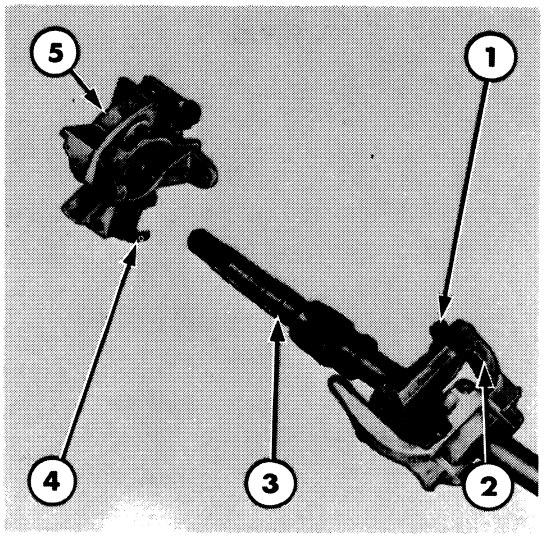


Figure 10
1. Pawl Ratchet
2. Lower Portion Tilt Mechanism
3. Steering Column
4. Pawl
5. Upper Portion Tilt Mechanism

2. Replace the two threaded pins using a suitable press or clamp, Figure 11.

3. Assemble the upper extension to the tilt mechanism using the three retainers and allen screws.

4. Remove the lock lever and assemble the upper and lower extensions.

5. Install the position control upper cover and replace the lock levers.

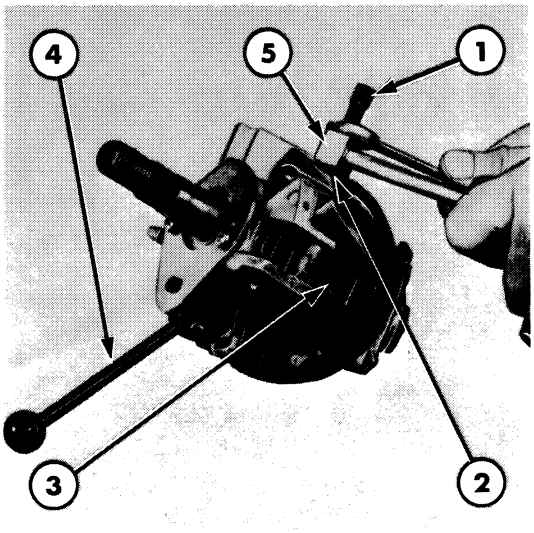


Figure 9
Tilt Mechanism
1. Remover, Tool No. 9661
2. Pin
3. Pawl
4. Lock Lever
5. Handle, Tool No. 9662

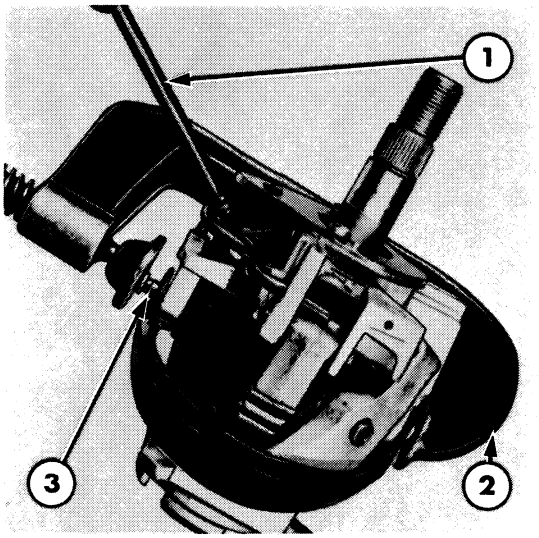


Figure 11
Tilt Mechanism
1. Lock Lever
2. Clamp
3. Threaded Pin

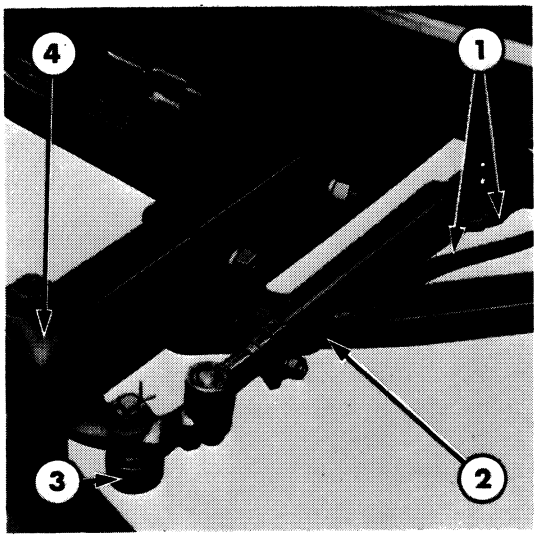


Figure 35
Steering Cylinder Location
1. Flexible Hose
2. Power Steering Cylinder
3. Cylinder Rod End
4. Left-hand Spindle Arm

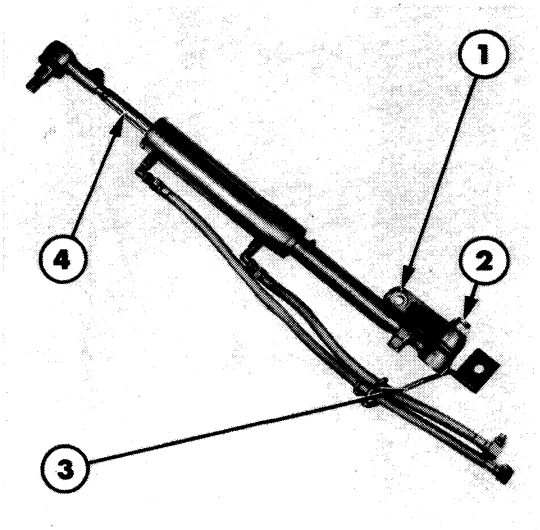


Figure 36
Steering Cylinder and Anchor
1. Anchor
2. Cylinder Assembly Retaining Nut
3. Feed Hose Support Bracket
4. Rod End Assembly

5. Carefully remove the steering cylinder assembly from the left-hand side of the tractor.

DISASSEMBLY

1. If a new assembly is to be installed, separate the cylinder assembly from the anchor, Figure 36.

2. Loosen the retaining clamps and unscrew the two end ball joints.

3. Remove the two hose elbows from the cylinder

4. Use a suitable "C" wrench to unscrew the gland and tube assembly. Remove and discard "O" ring.

5. Carefully slide the piston and rod assembly out of the cylinder and head assembly, Figure 37.

Chapter 7
8530, 8630, 8730 AND 8830 TRACTORS INSTALLED WITH DANA FOUR WHEEL DRIVE AXLE

Chapter 8
CARRARO TRANSFER BOX FOR 8530, 8630, 8730 AND 8830 TRACTORS INSTALLED WITH DANA FOUR WHEEL DRIVE AXLE

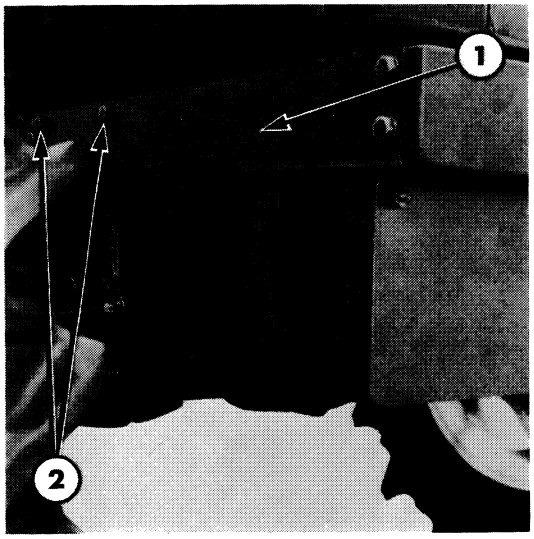


Figure 16
Fuel tank Support Assembly TW-25 and TW-35
1. Fuel Tank Support
2. Fuel Tank Support to Front Axle Support Bolts

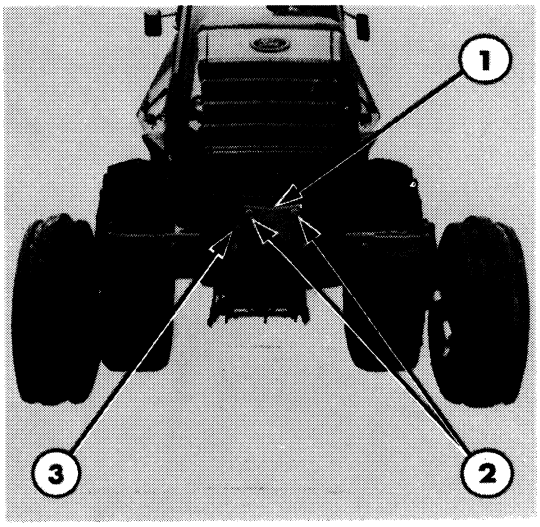


Figure 17
Front Axle Support Bracket
1. Font Axle Support Bracket
2. Front Axle Support Bracket Bolts (Upper)
3. Front Axle Support Bracket Bolts (Lower)

9. Support the fuel tank support assembly.

10. Remove the bolts securing the fuel tank support assembly to the main front axle support, Figure 16. Withdraw the assembly from the front of the vehicle.

All Models:

1. With the tractor on firm level ground position the front wheels straight ahead, apply the handbrake and chock the rear wheels.

2. Raise the front of the tractor and position safety stands under the engine to hold the front wheels just clear of the ground.

3. Disconnect the power steering cylinder hose assemblies at the connector plate located beneath, and attached to, the front axle main support. Cap the exposed ends.

4. Disconnect the connector plate from the front support.

5. Support the front axle assembly with a chain hoist.

6. Remove all bolts securing the front support bracket to the main front support, Figure 17.

7. Carefully remove the support bracket from the front centre axle support pin then withdraw the axle assembly from the main front support. Retain the two thrust washers on the front pin and single thrust washer on the rear pin.

8. Support the weight of the front axle support.

9. Withdraw the frame side member to front axle support bolts, Figure 18.

10. Remove the front axle support to oil pan bolts and front axle support to engine bolts, Figure 18. Withdraw the support from the vehicle.

11. Retrieve the shims located between the front axle support and engine assembly.

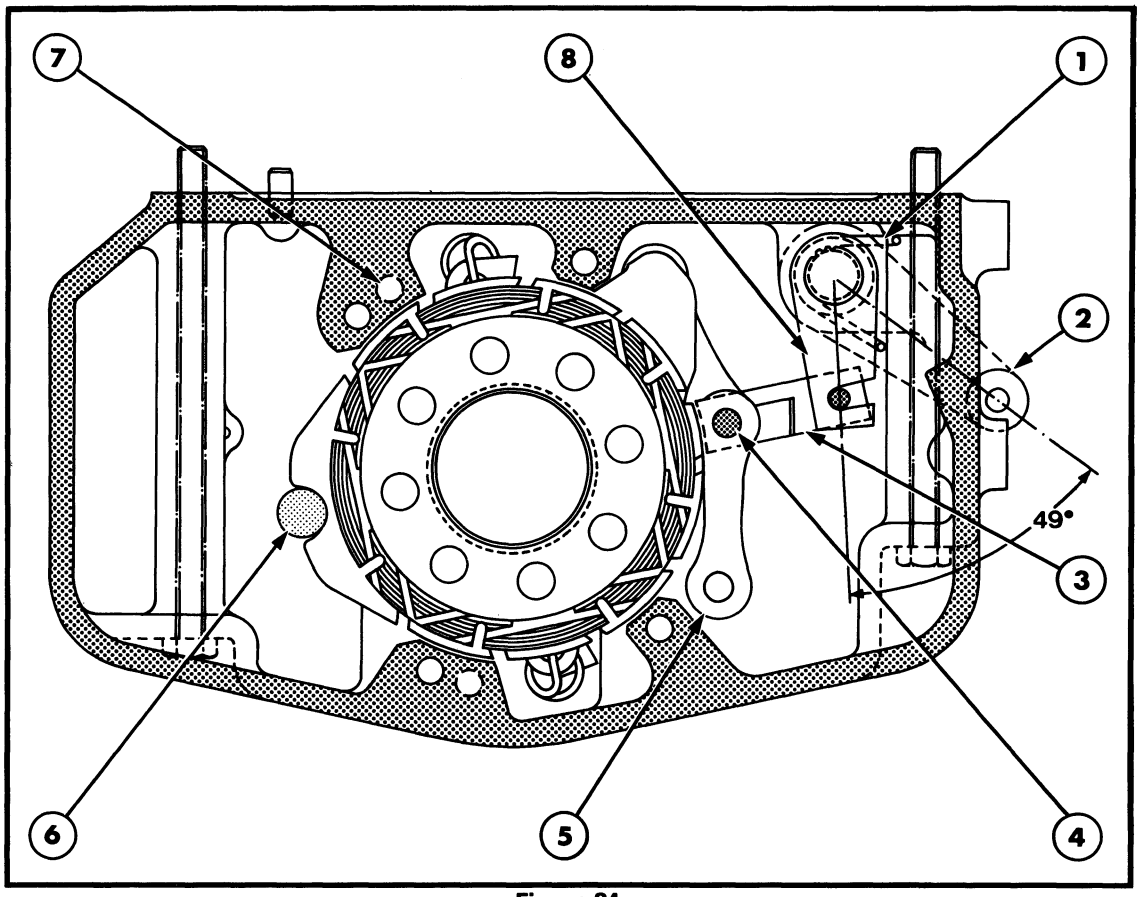


Figure 24
Brake Actuating Mechanism

1. Spring
2. Brake Lever and Shaft Assembly
3. Link
4. Clevis Pin
5. Actuator Assembly
6. Torque Pin
7. Brake Retaining Disc Dowel
8. Lever

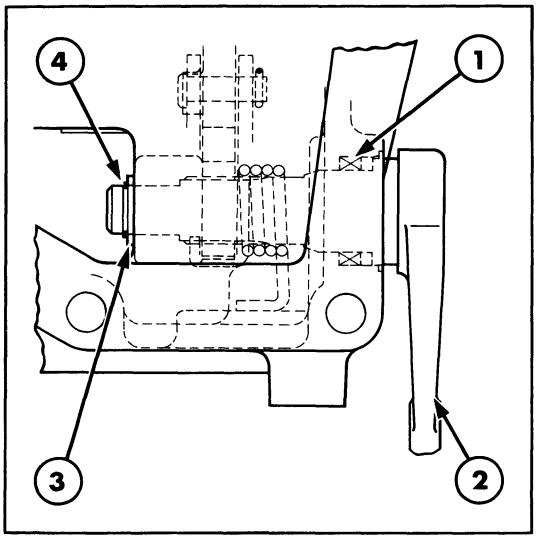


Figure 25
Brake Lever Assembly Installed

1. Seal
2. Brake Lever and Shaft Assembly
3. Shim Washer
4. Retaining Ring

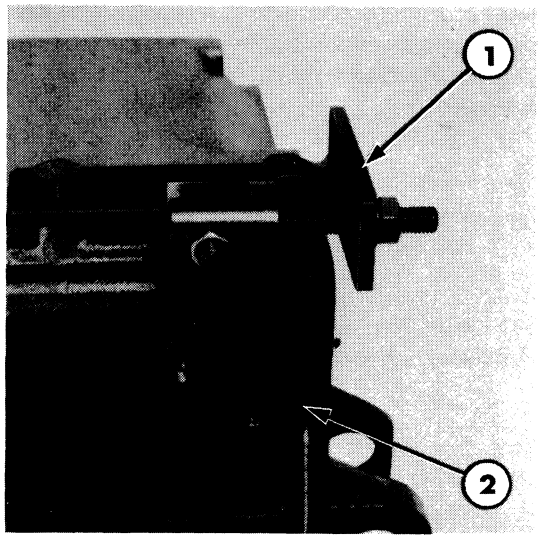


Figure 26
Handbrake Actuator Tool

1. Handbrake Actuator, Tool No. FT.3151 or 0563
2. Brake Lever and Shaft Assembly

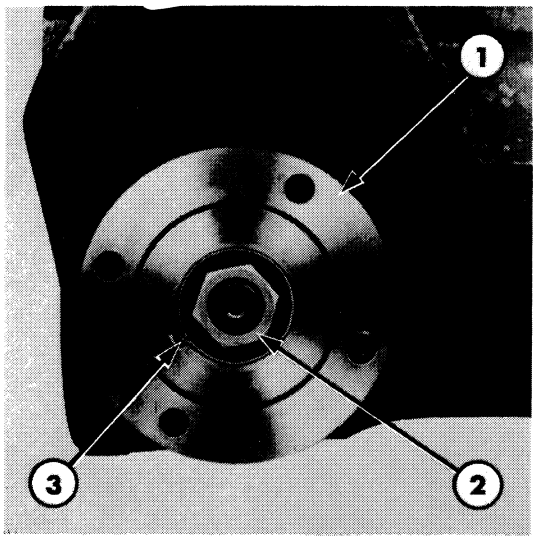


Figure 20
Pinion Drive Flange Securing Nut
1. Pinion Drive Flange
2. Securing Nut
3. Securing Nut Retainer

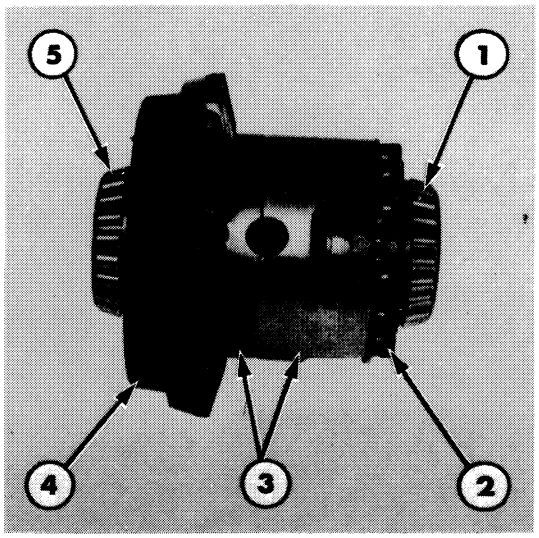


Figure 21
Differential Assembly
1. Bearing
2. Securing Bolts
3. Differential Casing
4. Crown Wheel
5. Bearing

Pinion Assembly

1. Remove the drive shaft guard, remove the pinion flange securing bolts and allow the drive shaft to rest on the ground.

2. Withdraw the pinion securing nut retainer and unscrew the securing nut, Figure 19. If necessary the pinion can be held using Pinion Flange Wrench, Tool No. FT.3122A or 0567.

3. Remove the pinion drive flange and drive the pinion assembly into the differential casing, collecting the pinion and bearing preload sleeve from within the casing.

4. Remove the pinion oil seal and rear bearing from the differential casing.

DISASSEMBLY

Differential

1. Remove the differential case securing bolts, Figure 21. Separate the two halves of the differential assembly.

2. Remove the bevel pinion gears and thrust washers, side gears, limited slip clutch plates and side gear thrust washers from each half of the casing.

B. SPECIFICATIONS — FRONT WHEEL DRIVE AXLE (Centre Drive)

FRONT AXLE TYPE	DOUBLE REDUCTION	
TRANSFER BOX	Driven from rear axle centre housing. Front axle drive engaged or disengaged by means of a multi-plate clutch.	
	Ford TW-5, TW-15 and TW-25	**Ford TW-35**
TRANSFER BOX RATIO	1.0493:1	1.1007:1
AXLE RATIO		
Overall	1:19.38	1:19.00
Crown Wheel and Pinion	1:3.23	1:3.17
Planetary Gear	1:6.00	1:6.00
OIL CAPACITIES		
Hub each		
Litres	0.75	0.75
Imp. pints	1.3	1.3
U.S. pints	1.6	1.6
Axle Differential		
Litres	5.50	8.0
Imp. pints	9.7	14.6
U.S. pints	11.6	17.1
Increased Capacity of Rear Axle with Transfer Box Installation Less Transmission Handbrake		
Litres	5.3	5.3
Imp. pints	9.3	9.3
U.S. pints	11.2	11.2
With Transmission Handbrake		
Litres	5.3	5.3
Imp. pints	9.3	9.3
U.S. pints	11.2	11.2

THREAD SEALANT

To Ford specification ESE-M4G204-A2

LUBRICANTS

Fill with the correct grade, quantity and type of oil as specified in the relevant Ford Tractor Operators Manual.

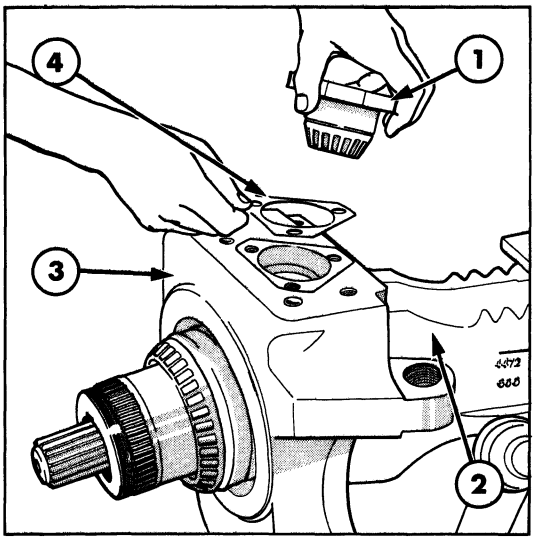


Figure 11
Swivel Pin Removal

1. Swivel Pin
2. Axle Casing
3. Swivel Casing
4. Shim (Upper Pin Only)

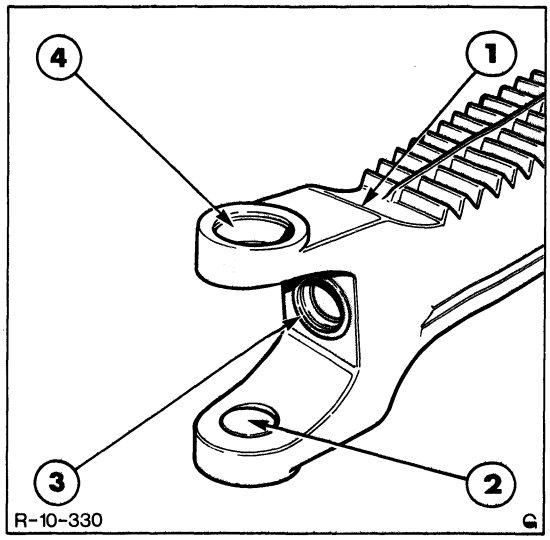


Figure 12
Swivel Bearing Cups

1. Axle Casing
2. Grease Retaining Plug
3. Axle Shaft Oil Seal and Bushing
4. Swivel Bearing Cup

4. Wrap masking tape around the axle shaft sun gear to protect the swivel casing oil seal during the swivel case removal.

5. Disconnect the steering track rod ball joint. Using a suitable sling, support the weight of the hub and remove the bolts securing the upper and lower swivel pins.

6. Remove the swivel pins complete with shims (upper pin only) and bearings, Figure 11. Identify the shims for installation on re-assembly.

7. Slide the swivel casing and hub assembly away from the axle and withdraw the axle shaft from the axle casing.

INSPECTION AND REPAIR

1. Inspect the swivel bearing and cups for wear and damage, replacing if necessary. To remove the swivel bearing cups drive out the grease retaining plugs, Figure 12.

2. Replace the 'O' ring seal located on the bearing sealing caps.

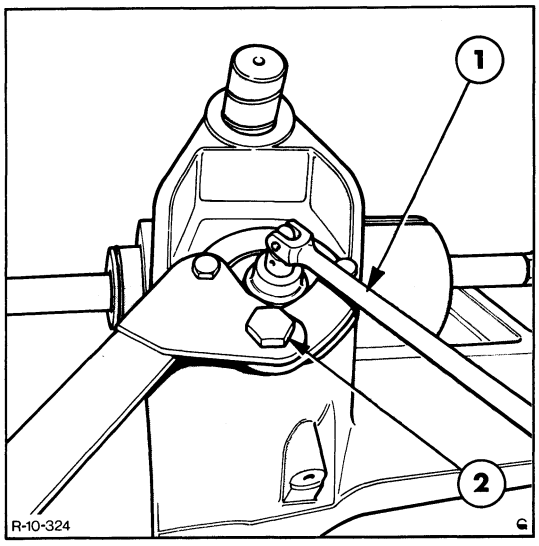


Figure 30
Tightening Pinion Nut

1. Wrench
2. Flange Wrench, Tool No. FT 3122A or 0567

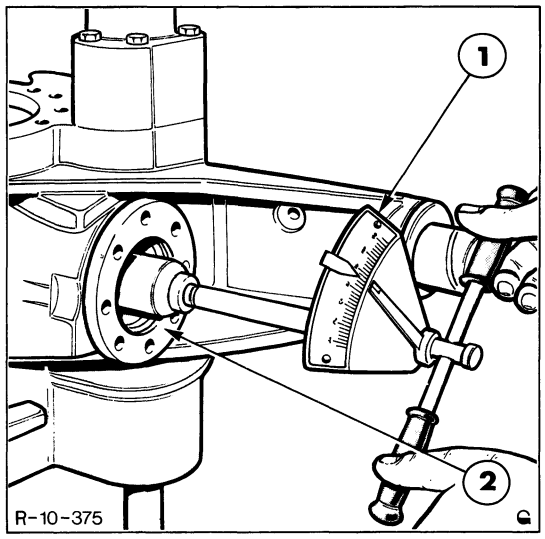


Figure 31
Measuring Pinion Bearing Turning Torque

1. Torque Meter
2. Pinion Flange

8. Install a new pinion nut retainer to prevent any further rotation of the nut.

Differential Installation

1. Install the original or selected shims between the differential bearing cups and the axle housing. Install the right hand axle shaft in the axle housing.

2. Locate the differential in position engaging the crown wheel teeth in the pinion teeth. Install the left hand axle housing and secure with the bolts tightened to the specified torque, see "Specifications" – Chapter 6.

3. Install the left hand axle shaft.

4. Remove the differential drain plug and mount a dial indicator on the axle casing with the plunger located perpendicular onto a tooth of the crown wheel, Figure 32.

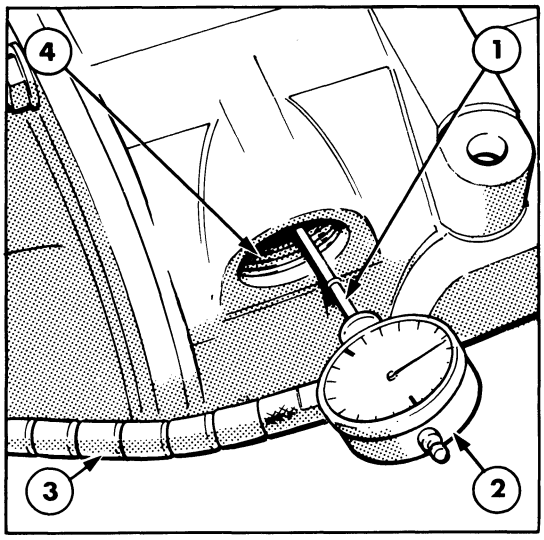


Figure 32
Measuring Crown Wheel to Pinion Backlash

1. Dial Indicator Plunger
2. Dial Indicator
3. Dial Indicator Stand
4. Differential Drain Plug Hole

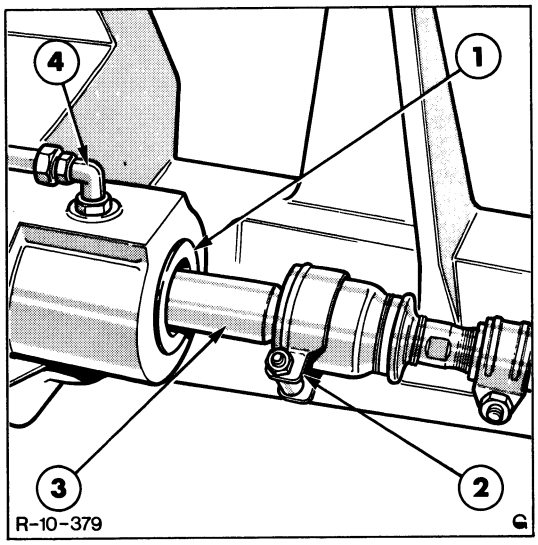


Figure 55
APL 355 Axle Steering Cylinder Right Hand Side

1. Cylinder Sleeve
2. Steering Stop
3. Cylinder Rod
4. Hose Connection

7. Withdraw the cylinder rod, complete with piston assembly, from the cylinder.

8. **APL 355 Axle**

   Remove the steering hose and elbow connection from the right hand end of the cylinder, Figure 55.

   The sleeve in the steering cylinder housing can be pushed out of the left hand end together with the gland located in the right hand end of the cylinder.

9. **APL 365 Axle**

   Disconnect the steering hose from the right hand steering cylinder, remove the end cap and withdraw the sleeve from the steering cylinder housing.

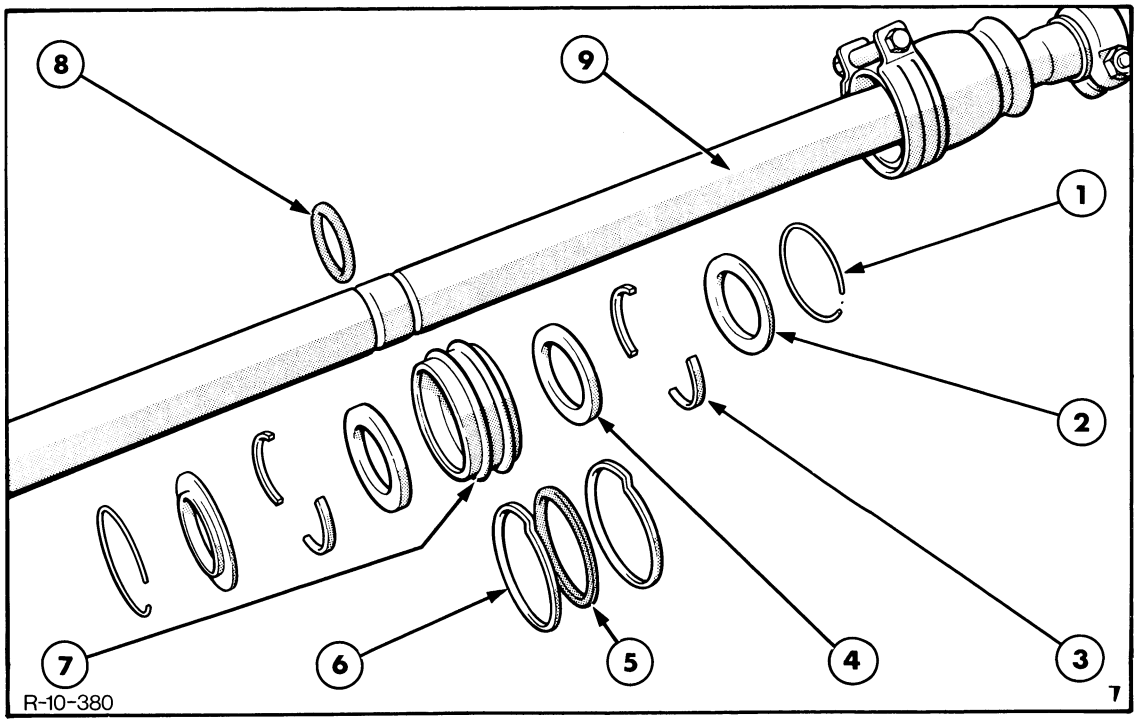


Figure 56
Steering Cylinder Piston Components

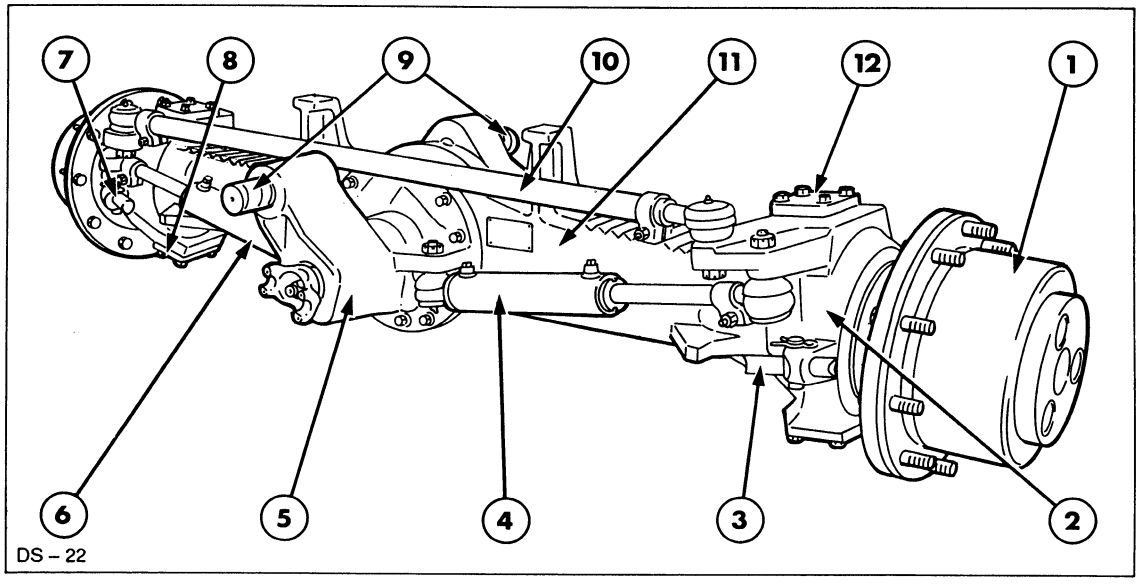
1. Snapring
2. Collar
3. Split Ring
4. Spacer
5. Seal
6. Piston Ring
7. Piston
8. 'O' Ring Seal
9. Cylinder Head

PART 10
FRONT AXLE

Chapter 7
8530, 8630, 8730 AND 8830 TRACTORS INSTALLED WITH DANA FOUR WHEEL DRIVE AXLE

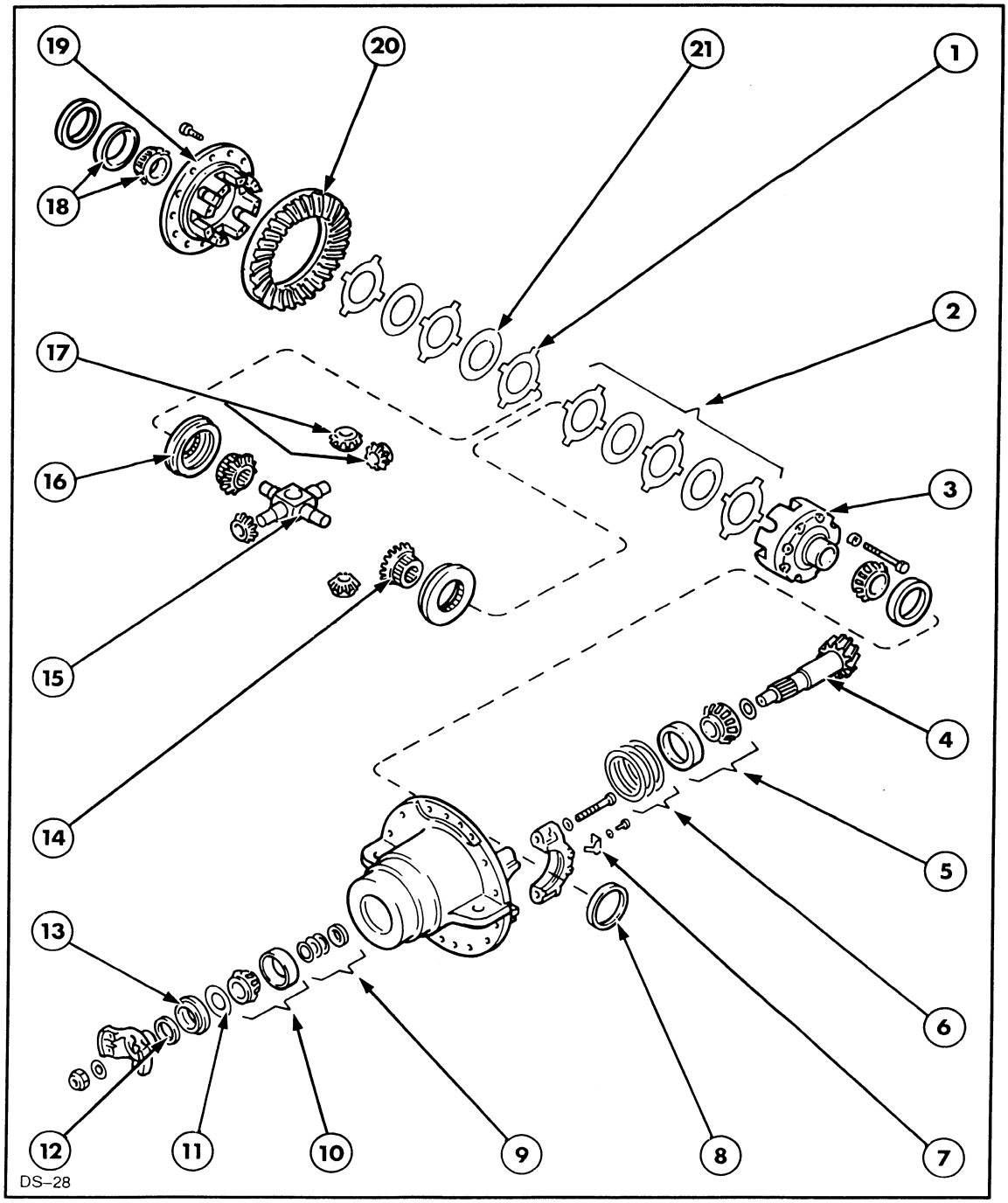
WARNING: *When overhauling the axle always ensure the tractor and axle is fully supported on axle stands and that the rear wheels are blocked to prevent any movement of the tractor.*

A. DESCRIPTION AND OPERATION



1. Front Axle Assembly

1. Planetary Reduction
2. Swivel Housing
3. Adjustable Stop
4. Right Hand Steering Cylinder
5. Differential Unit
6. Left Hand Cylinder
7. Adjustable Stop
8. Swivel Pin
9. Pivot Pins
10. Track Rod
11. Centre Housing
12. Swivel Pin

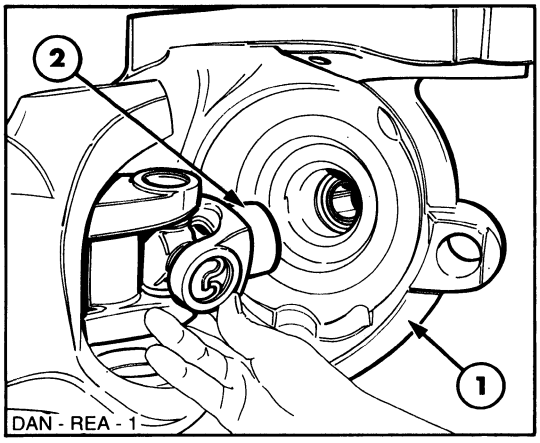


49. Differential Assembly – Exploded View

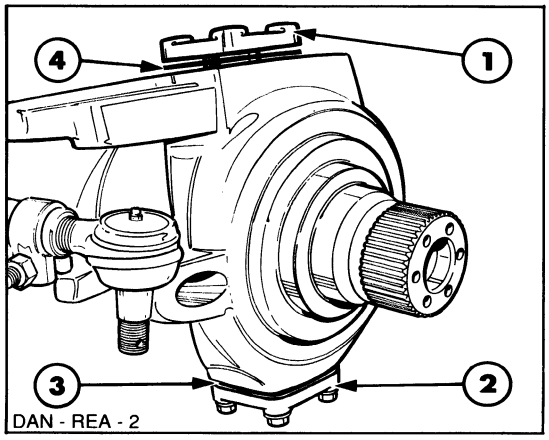
1. Separator Plate
2. Differential Lock Clutch Pack
3. Half Casing
4. Pinion Drive Shaft (10 Teeth)
5. Inner Taper Roller Bearing
6. Pinion Engagement (Positioning) Shims
7. Adjuster Lock Plate
8. Bearing Preload Adjuster
9. Bearing Preload Shims
10. Outer Taper Roller Bearing
11. Oil Slinger
12. Dust Shield
13. Pinion Oil Seal
14. Side Gear
15. Spider
16. Pressure Plate
17. Spider Gears
18. Differential Bearing
19. Half Casing
20. Crown Wheel (41 Teeth)
21. Internally Splined Plate

NOTE: *At this stage of re–assembly the front axle may be installed to the tractor front support or alternatively, the axle may be fully re–assembled before installation to the tractor.*

SWIVEL PIN BEARING ADJUSTMENT



99. Swivel Housing Installation
1. Swivel Housing
2. Axle Shaft Yoke



100. Swivel Pin Installation
1. Upper Swivel Pin
2. Lower Swivel Pin
3. Lower Shims : 0.015 in (0.375 mm)
4. Upper Shims : 0.015 in (0.375 mm)

- Coat swivel pins and bearings with No 2 Lithium grease.

- Position swivel housing onto axle housing and ensure that yoke is guided into swivel housing bore.

- Install 0.015 in (0.375 mm) shim pack beneath the upper and lower swivel pins then tighten swivel pin retaining bolts evenly to 100–115 lbf ft (136–155 Nm).

- Turn swivel housing to the right and position torque meter on a swivel pin bolt.

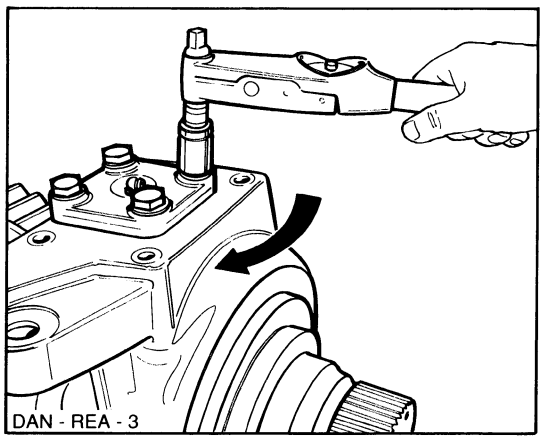
- Measure torque required to turn swivel housing.

- If turning torque is not within specification of 8–15 lbf ft (11–20 Nm), adjust shim thickness until correct torque is achieved. Reducing shim thickness will increase turning torque. Increasing shim thickness will reduce torque.

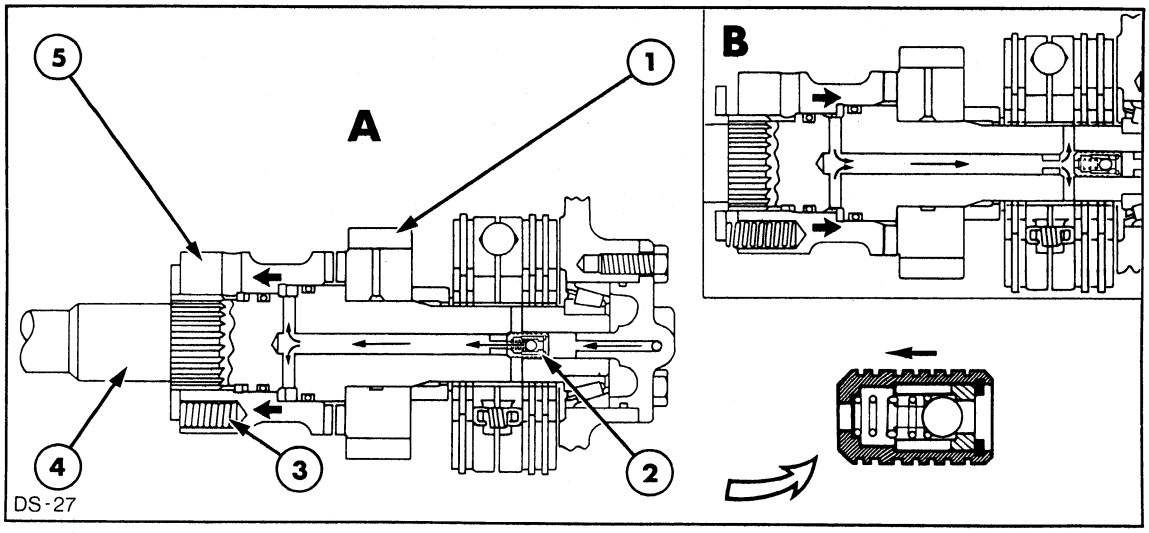
  Shims are available in the following sizes: 0.002 / 0.006 / 0.010 / 0.015 / 0.030 in (0.05 / 0.15 / 0.25 / 0.375 / 0.75 mm)

  NOTE: *Ensure shims installed are divided equally between the upper and lower swivel pin.*

- After selection of shim install new swivel pin oil seals.



101. Checking Swivel Housing Turning Torque



2. Transfer Box Clutch Operation Schematic

A. Four Wheel Drive Disengaged
B. Four Wheel Drive Engaged

1. Driven Gear
2. Check Valve
3. Return Springs (4 off)
4. Output Shaft
5. Piston and Sliding Clutch

DISENGAGEMENT

When the solenoid valve is actuated, oil flow is directed through a transfer tube to the centre bore of the output shaft. Oil pressure seats the double check valve located in the output shaft bore, but also opens the inner check valve to flow to the piston.

Oil pressure builds up until the piston (i.e. sliding clutch) moves against the springs, disengaging the driven gear.

ENGAGEMENT

When the solenoid valve is deactivated, oil pressure is released in the centre bore.

The sliding clutch springs move the coupling towards the driven gear, oil pressure in the piston area opens the check valve, which allows a quick release of oil pressure to sump, and rapid spring engagement of the dog clutch.

40 km/h Ratio Powershift Transmission models feature automatic engagement of Four Wheel Drive when both tractor foot brakes are applied to provide four wheel braking.

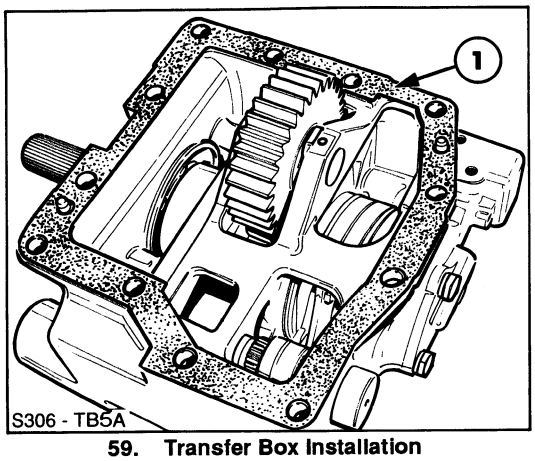
When the brake pedals are depressed an electrical switch on the brake pedal housing deactivates the circuit to the transfer box solenoid and engages the four wheel drive axle.

The electrical circuit for operation of four wheel drive braking is shown at the rear of this chapter.

TRANSMISSION PARKING BRAKE

The wet disc brake is operated by the hand brake lever and cable. Braking is applied to front and rear axles with the engine shut off or when operating in four wheel drive.

H. TRANSFER BOX INSTALLATION

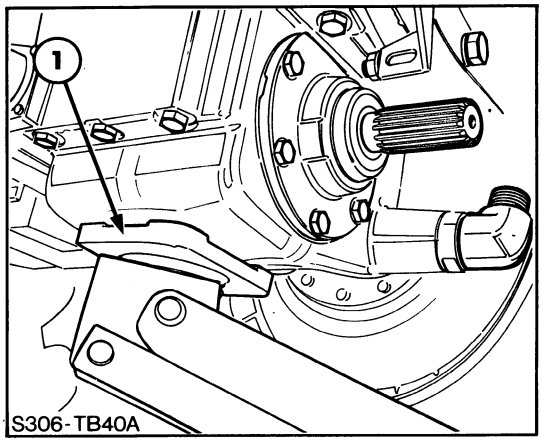


59. Transfer Box Installation
1. Gasket

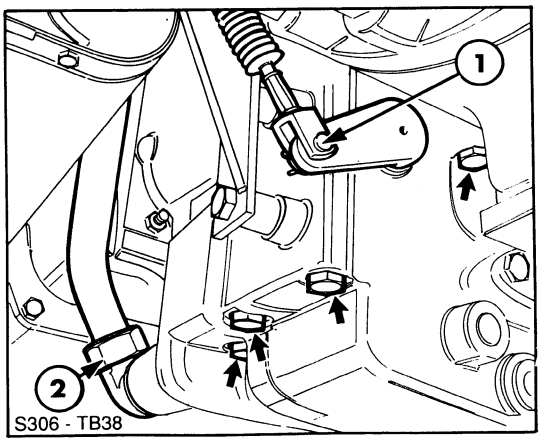
Ensure rear axle and transfer box mating surfaces are clean.

Locate gasket on transfer box and raise the transfer box into position.

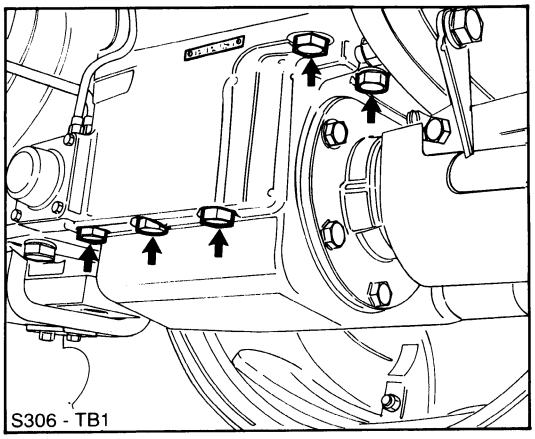
Install and initially hand tighten bolts.



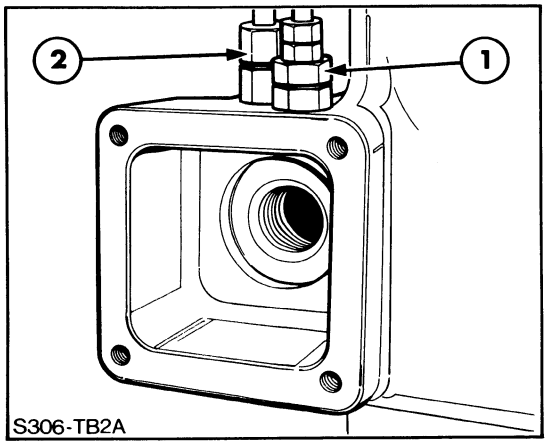
60. Transfer Box Installation
1. Trolley Jack



61. Transfer Box Installation
1. Handbrake Cable Clevis Pin
2. Transmission Pump Suction Pipe



62. Bolt Tightening Torque
Tightening Torque 55 lbf ft (75 Nm)



63. Solenoid Connections
1. Electrical Conduit
2. Low Pressure Supply Pipe

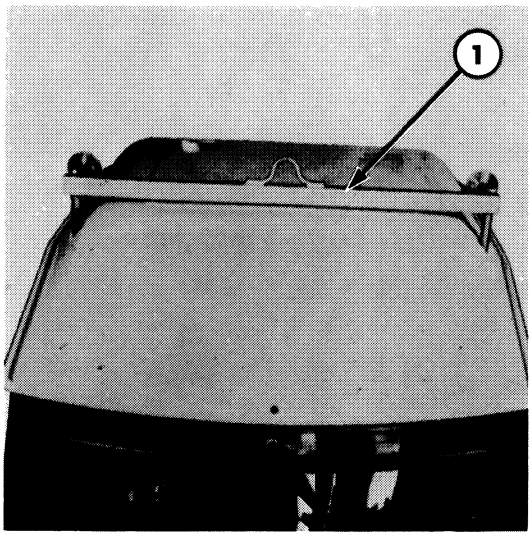


Figure 4
Ford Flat Deck Cab Lifting Equipment
1. Spreader Bar, Tool No. 2420

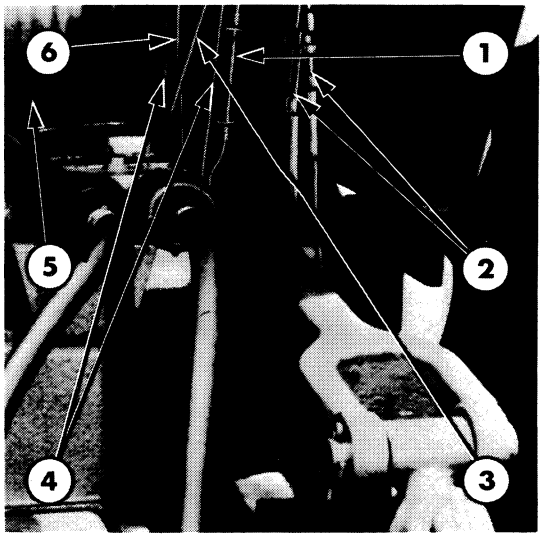


Figure 5
Hydraulic Control Linkage
1. H.P.L. Control Rod
2. Remote Cylinder Flow Control Cables
3. System Selector Lever
4. Remote Cylinder Control Rods
5. P.T.O. Cable
6. Flow Control Rod

REMOVAL

IMPORTANT: *Do not tilt the cab rearwards as this will damage the cab rear mountings.*

For Ford Tractors equipped with air conditioning it will be necessary to disconnect the quick release connectors located over the rear axle, see "ACCESSORIES AND GENERAL" — Part 13, Chapter 1.

1. Remove the split pin and clevis pin to disconnect the P.T.O. cable at the left-hand side of the rear axle centre housing, Figure 5. Remove the cable attaching bracket and clip located on top of the hydraulic lift cover.

2. Remove the split pin and washers to disconnect the system selector rod and the H.P.L. control rod at the hydraulic lift cover.

3. Remove the split pins and washers to disconnect the remote cylinder control rods and the flow control rod.

4. Turn the remote cylinder flow control knob assembly clockwise at the console, loosen the locknut on the cable and disconnect the cables, Figure 6.

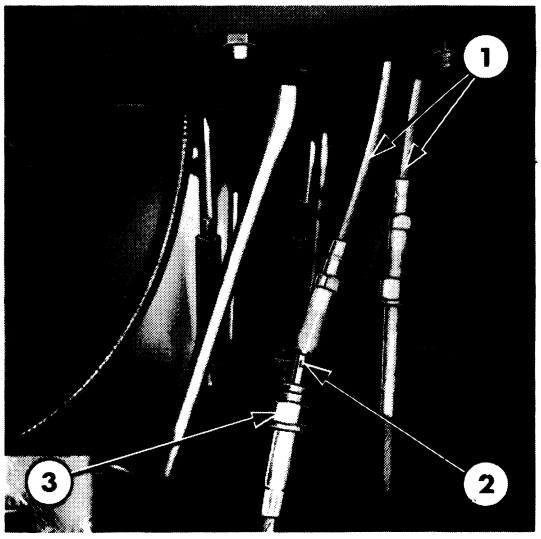


Figure 6
Hydraulic Control Linkage
1. Remote Cylinder Flow Control Cables
2. Disconnect Point
3. Locknut

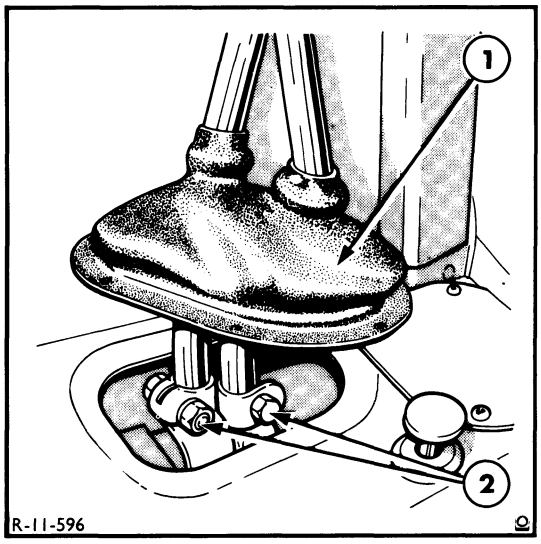


Figure 7
Gear Shift Levers

1. Gear Shift Boot
2. Clamp Bolts

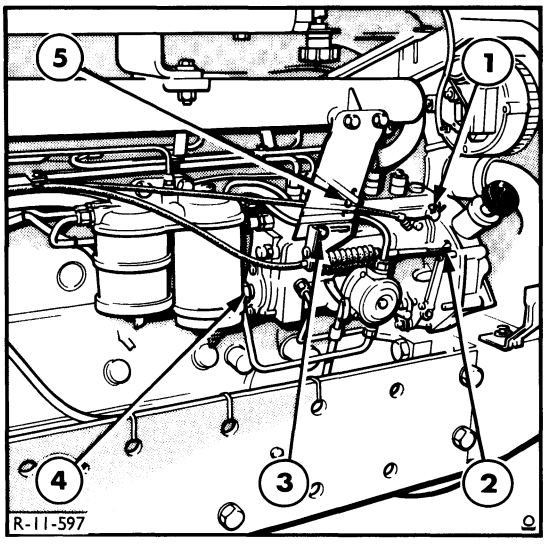


Figure 8
Engine Control Cables

1. Fuel Pump Cut-Out Lever
2. Throttle Cable Retaining Clip
3. Throttle Bracket Retaining Bolt
4. Proofmeter Cable
5. Cut-Out Cable Retaining Screw

5. Disconnect the handbrake cable (where fitted) from the actuating lever by removing the clevis pin and split pin from the cable retaining bracket, then slip the cable out of the bracket and push through to the underside of the cab.

Cab External

1. Disconnect the engine stop control cable, Figure 8, from the fuel injection pump and pull back to hang freely from the front of the cab.

2. Unclip the throttle cable from the fuel injection pump throttle lever, Figure 8. Remove the throttle cable support bracket from the side of the engine and allow the cable to hang freely from the front of the cab.

3. Disconnect the proofmeter drive cable from the fuel injection pump and allow to hang freely in front of the cab.

4. Shut off the heater water control valves. Release the retaining clamps and pull the hoses off the control valves, then remove the plastic straps and allow the hoses to hang freely in front of the cab. Cap or plug the exposed hose ends to prevent entry of dirt.

5. Disconnect the main wiring harness and two auxiliary harnesses located beneath the steering motor, Figure 9.

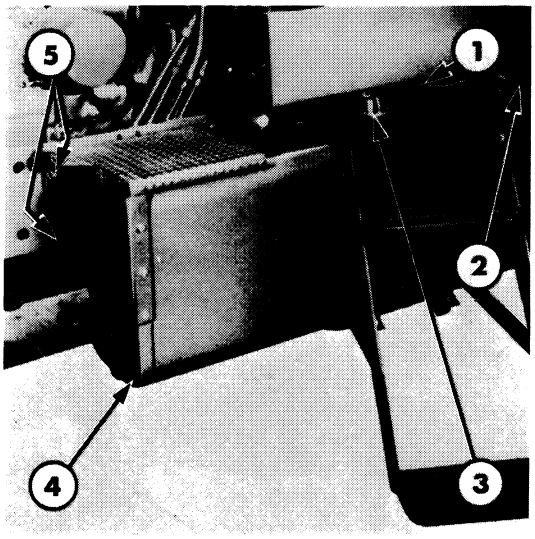


Figure 7
Auxiliary Fuel Tank
1. Fuel Sender Wire
2. Rear Support Pin
3. Fuel Lines
4. Auxiliary Fuel Tank
5. Front Support Bolts

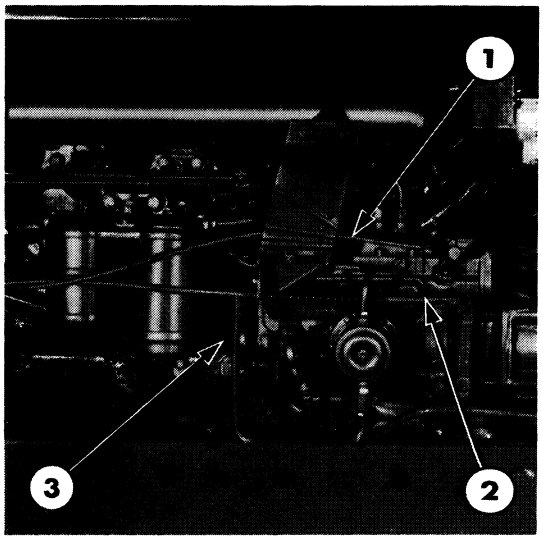


Figure 8
Disconnecting Engine Controls
1. Fuel Shut-Off Cable
2. Throttle Cable
3. Tachometer Cable

7. Close the fuel shut-off valve on the main tank and remove the auxiliary tank fuel hose from the valve fitting.

8. Disconnect the fuel lines and fuel gauge sender wire from the auxiliary fuel tank, Figure 7.

9. Place a suitable container under the auxiliary fuel tank and drain the fuel.

10. Remove the auxiliary fuel tank front support bolts and rear support pin then remove the tank and step assembly, Figure 7.

11. Remove the tube clamp attached to the inner side of the left-hand frame member then withdraw the attaching bolts and remove the frame.

12. Remove the bolt retaining the front main harness multi-connector at the front of the cab or platform behind the engine. Unplug the connector.

13. Disconnect the battery cables and wires from the starting motor and solenoid. Withdraw the retaining bolts and remove the starting motor assembly.

14. Disconnect the throttle cable, tachometer cable and fuel shut-off cable from the fuel injection pump, Figure 8. Allow the cables to hang freely from the front of the cab or platform.

15. Install either Tractor Splitting Kit, Tool No. MS.2700 or Tractor Splitting Stand, Tool No. 201387, and insert wooden wedges between the support assembly and the front axle to prevent movement.

PART 13
ACCESSORIES AND GENERAL

Chapter 1

AIR CONDITIONING SYSTEMS — TRACTORS PRIOR TO NOVEMBER 1985

A. AIR CONDITIONING SYSTEMS — DESCRIPTION AND OPERATION

The optional air conditioning system improves the comfort and health of the operator by controlling the temperature, humidity, cleanliness and circulation of the air within the cab.

Heat reduction is effected by circulating the air through a cooling unit called an evaporator. This unit also serves to reduce the moisture content of the air for the wet surface of the evaporator collects dust and pollen particles which drain off with the condensed moisture.

The tractor cab air conditioning system, Figure 1, consist of two heat exchangers and a pump inter-connected by tubing. One heat exchanger (evaporator) is located in the roof of the cab while the second heat exchanger (condenser) is situated in front of the engine coolant radiator.

A special refrigerant, which can be easily heated or cooled, is circulated through the two heat exchangers by the pump (Compressor).

Heat always flows from hot to cold and, based on this fact, the tractor cab is air conditioned in the following manner:

A low temperature refrigerant in the evaporator absorbs heat from the hotter air in the operator's compartment, thereby cooling the air.

The now warmer refrigerant is pumped by the compressor to the condenser.

Refrigerant Can Valve

All refrigerant cans are sealed and must be opened with a can valve which, after instalation, serves to puncture the can and controls the escape of refrigerant.

NOTE: *Ensure the valve sealing gaskets are in good condition before installing the valves.*

The can valves are of two types as follows:

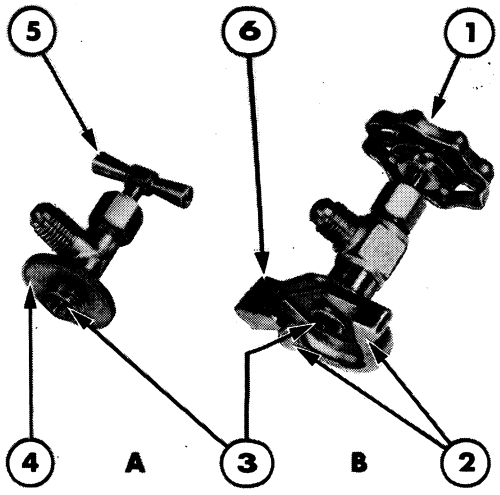


Figure 10
Refrigerant Can Valves
A. Screw Type Valve
B. Flat Type Valve
1. Handle
2. Locking Lugs
3. Valve Sealing Gaskets
4. Locking Ring
5. Handle
6. Cam Lever

SCREW TYPE VALVE

The screw type valve, Figure 10, features a locking ring. To install the valve:

- Turn the valve handle anti-clockwise to the fully open position.
- Ensure the locking ring is turned anti-clockwise to the top of the threaded section.
- Screw the valve assembly securely onto the can.
- Turn the locking ring clockwise to fully secure the valve to the can.
- After the valve is installed, rotate the handle clockwise to close the valve and pierce the can.

FLAT TYPE VALVE

The flat type valve, Figure 10, features a camlock action. To install the valve:

- Turn the valve handle anti-clockwise to the fully open position.
- Rotate the valve one turn anti-clockwise relative to the valve base and secure the locking lugs over the can flange.
- Pull the cam lever to lock the valve to the can.
- Rotate the valve clockwise and tighten to ensure effective sealing.
- After the valve is installed, rotate the handle clockwise to close the valve and pierce the can.

Service Valves

The air conditioning system is equipped with Schrader type service valve, which features a service gauge port to facilitate discharge evacuation and charging of the system. The service valve is mounted on the compressor and incorporates connections for the low and high pressure side hose fittings.

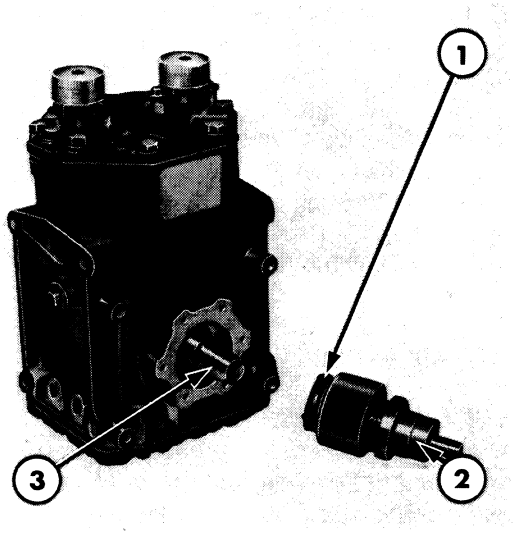


Figure 21
Shaft Seal Removal

1. Shaft Seal
2. Compressor Seal Puller—Tool No. 6390 or 10549
3. Shaft

RE-ASSEMBLY

1. Coat exposed surfaces of the crankshaft with clean refrigeration oil. Dip a new bellows seal assembly in clean refrigeration oil. Place the seal assembly over the crankshaft with the bright metal cup end facing outward. Hand push the bellows seal assembly on to the shaft to a position beyond the shaft taper. Do not push the seal into the cavity.

2. Assemble a carbon seal in the bellows seal assembly, checking before doing so to see that the bellows seal assembly and the crankshaft are free from dirt and foreign material. Assemble the carbon seal so that the raised face is ouwards and that the notches in the seal ring line up with the ribs in the bellows seal assembly. Cover exposed surface of the carbon seal with clean refrigeration oil.

3. Insert a new "O" Ring into the crankcase groove on the mating surface for the front seal plate.

4. Place a new front seal plate over the shaft with the machined surface facing the carbon seal.

5. Place a new seal plate retainer over the shaft and line up the mounting holes. With one hand on each side of the seal place retainer, push the retainer, seal plate and bellows seal assembly up against the crankshaft.

6. Install the bolts in the seal plate and finger tighten. Remove the tool.

7. Tighten the seal plate bolts in a circular or a diagonal pattern to the correct torque, see 'Specifications'.

8. Rotate the shaft, by hand, 15—20 revolutions to seat the seal parts.

9. Place a new dust shield on the crankshaft so the cupped portion is toward the seal plate. Puch the shield onto the crankshaft as far as possible with fingers only. Keep the shield square with the shaft.

NOTE: *After re-assembly, fill and check the compressor oil level.*

CYLINDER HEAD AND VALVE PLATE REMOVAL

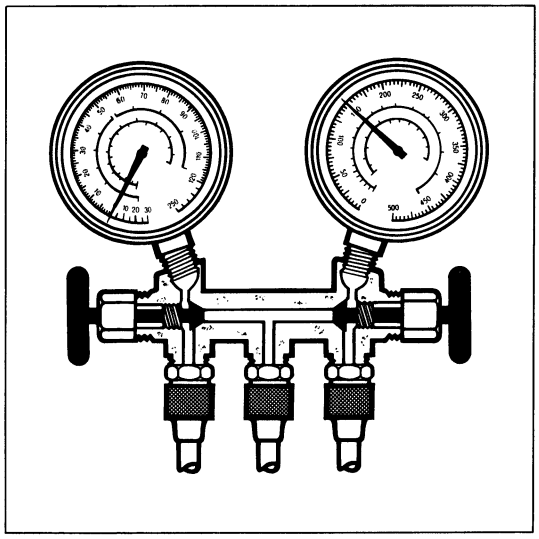
1. Remove the 12 bolts from the cylinder head.

2. Remove the valve plate and cylinder head assembly from the crankcase by lightly tapping upwards with a fibre hammer on the overhanging edge of the valve plate.

3 Remove the valve plate from the cylinder head by holding the valve plate and tapping sideways against the cylinder head with a fibre hammer or mallet. Discard the valve plate.

4. Remove all particles of gasket, dirt and foreign material from the cylinder head and cylinder face surfaces, making sure not to scratch or nick mating surfaces or edges.

9. INSUFFICIENT COOLING
LOW SIDE LOW HIGH SIDE LOW



Condition

1. Low side gauge reading too low. Should read 15—30 lbf/in² (1.03—2.07 bar) (1.05—2.11 kgf/cm²).

2. High side pressure too low. Should read (185—205 lbf/in²) (12.75—14.12 bar) (13.01—14.41 kgf/cm²).

3. Evaporator air cool, but not sufficiently cold.

4. Expansion valve inlet pipe surface shows considerable moisture or frost.

Diagnosis

Expansion valve is not permitting a sufficient flow of refrigerant. Causes include; Valve stuck in restricted or closed position, valve screen clogged, or insufficient amount of refrigerant in temperature sensing bulb.

Correction

1. Place finger on expansion valve inlet. If cold to touch, proceed as follows:

   (a) Operate system at maximum cooling.

   (b) Spray refrigerant on head of valve and/or temperature sensing bulb.

   (c) Check low side gauge. It should show a vacuum reading.

2. If the test (above) shows that the expansion valve is operating satisfactorily, clean the surface of the evaporator outlet pipe and the temperature sensing bulb, and clamp the bulb to the pipe.

3. If Step 1 indicates the valve is defective or if the valve inlet surface shows frost or heavy moisture, proceed as follows:

   (a) Discharge the system.

   (b) Replace the expansion valve.

4. After performing Step 3 above, proceed as follows:

   (a) Make sure temperature sensing valve is properly mounted on the evaporator oulet pipe.

   (b) Evacuate the system.

   (c) Charge the system.

5. Performance test the system.

PART 13
ACCESSORIES AND GENERAL

Chapter 3
HYDRAULIC TRAILER BRAKE VALVE

A. HYDRAULIC TRALER BRAKE VALVE — DESCRIPTION AND OPERATION

Ford TW Series Tractors may be fitted with an hydraulic valve for the control of hydraulically operated trailer brakes.

The valve is attached to a bracket located on the right hand side of the rear axle centre housing, directly below the hydraulic pump cover assembly, Figure 1.

A pilot pressure tube connects the trailer brake valve to the right hand tractor brake circuit via a "T" fitting in the hydraulic tube to the right hand wheel cylinder.

Operation of the tractor brake pedals, which must be locked together during all towing operations, results in a pressure being generated in the hydraulic brake circuit. This pressure is sensed through the pilot pressure tube, at the trailer brake valve which directs oil from the hydraulic system pump to the trailer brakes. The trailer braking intensity is proportional to the effort applied on the tractor brake pedals. Feedback is provided by the trailer brake valve to give a sense of 'feel' to the operator to aid precise braking.

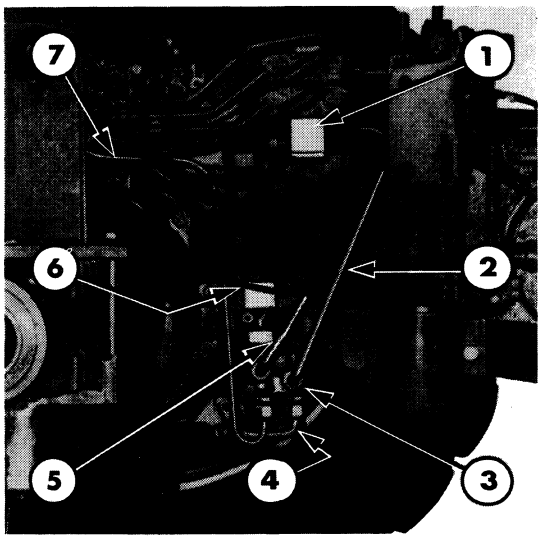


Figure 1
Trailer Brake Valve Installation — TW-5, TW-15 and TW-25

1. Adaptor Plate
2. Hydraulic System Oil Return Tube
3. Trailer Brake Valve
4. Hydraulic System Oil Feed Tube
5. Valve-to-Reservoir Return Tube
6. Pilot Pressure Tube
7. Trailer Brake Coupling Tube